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T. COMMERFORD MARTIN, JOSEPH WETZLER. Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
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Vol. VIII. NEW YORK, NOV. 20, 1886. No. 21.

THE result of the hearing in the Government suit against the Bell patent, at Cincinnati, cannot be very satisfactory to the Administration. It is said that President Cleveland is annoyed, and that Mr. Thurman is surprised. They might well both be disgusted; a large portion of the public certainly is. It appears now that if suit is to be brought on the merits of the case, it must be in Massachusetts. Perhaps the Government will now feel inclined to wait on the course of events in the United States Supreme Court.

THE House electro-phonetic telegraph patent of 1868 is at this moment attracting general attention because it is said to be a complete "anticipation" of the Bell patent and telephone. The assertion is made that with certain modifications, made in some of its details, the House apparatus can be induced to talk. We will not deny its powers of speech, but will simply refer our readers to the reproduction we make in this issue in fac-simile, of the drawings that accompanied the patent of 1868. We give also the inventor's own description of his—telephone, shall it be?

THE time seems not far distant when nearly every telegraph wire, even those connecting points of minor importance, will be at least duplexed in its carrying capacity. The methods by which this can be accomplished are becoming so much simplified that it no longer requires the attendance of an expert electrician to keep the apparatus in working order, and hence their enlarged field of employment. In our last issue we described a simple method by which Mr Phelps duplexes the line employed for the transmission of telegraphic signals to moving trains. As usual, the condenser plays an important part in the system, forming the passage for the electrical impulses when the local key is open during the regular Morse transmission.

ON the basis of the present charge for 825 arc lamps employed in lighting certain parts of Brooklyn, some one has figured out very carefully what it would cost, at exactly the same rate, to light the whole city in that way. We do not see the pertinency of the argument—if it be one—against electric lighting, and of course the calculation is absurdly incorrect. The principles of wholesale production apply in this case as in any other, and the more light used the lower relatively is the cost. It is a pity all Brooklyn is not lighted by electricity. Those parts which enjoy the electric light present an air of cheerfulness and brilliancy at night that is in remarkable contrast with the gloomy dinginess of the streets lit by gas, and every new arc lamp put up in the city is welcomed with hearty pleasure and satisfaction by the people.

IN his very fine oration delivered at Cambridge, Mass., on the two hundred and fiftieth anniversary of the foundation of Harvard University, Mr. James Russell Lowell expressed the belief that the modern seat of learning had special duties imposed upon it for various reasons, such as the decay of religious faith, the worship of mere wealth, and the uprising of labor. This was a time, he said, among other things of that kind, "when the electric telegraph, by making public opinion simultaneous, is also making it liable to those delusions, panics, and gregarious impulses which transform otherwise reasonable men into a mob." We would like Mr. Lowell to inform us, or any body else, of any instance in which the telegraph has by rendering public opinion prompt to act everywhere, turned men of sense into riotous fools. We make bold to say that there is no incident of that nature on record, but that there are several instances known in which the flashing of intelligence over the wires has served to show how quickly error can be suppressed, and how readily men of reason can judge aright with the facts before them. Does Mr. Lowell want to take us back to the days when people offered prayers for the king a year after the king's death? Does he think that this busy, stirring, wide-awake world of ours can do its work with a nervous system as slow to act as that of a whale?

AN address on the object of a university, by the late Dr. Elisha Mulford, delivered in 1883, has just made its appearance for the first time in print. It deserved publication, being a liberal, generous and keen-sighted consideration of a most important subject. There is one passage in regard to physical research that is highly suggestive. Pointing out the necessary limits of the opportunities offered in the college laboratory for investigation, he says: "There are in no university the means of research in these departments which are found in the shops of Thomas Edison at Menlo Park, and the Bessemer steel works, or the offices of the Western Union Telegraph Company; and all the Bessemer steel works are subject to the constant study and experiment of the rare genius of the machinist, whose patents alone give to the works their great value and income." This is true, and it is a good argument for giving the student, in preference to a narrow course in one or two departments, the more general disciplinary culture of his mind. But though it may not be the object of the university to train men in specialties, there is still vast room for improvement in the means with which our universities and colleges are equipped for teaching the facts and principles of science. Probably Cornell is the only place to-day that has any cause to be proud, for example, of its electrical apparatus, but it might be much better off in that respect, and so might Johns Hopkins.

THE question of operating street cars by electricity is one of the utmost interest and importance at the present time, and without exaggeration it may be said to be occupying the thoughts of every prominent street car man in the country. Special attention has been directed during the last week or two in New York to the Julien car now running on the Eighth avenue road. This car, which took the first prize in a prolonged and severe competition at the Antwerp Exhibition, derives current for the motor from accumulators, and, as we can testify from personal experience, runs with a full load of passengers with the utmost ease and smoothness. The system presents many points of comparison with that of direct transmission of current. Both have their advocates and both will undoubtedly find very general application. We illustrate and describe the Julien car and secondary battery in this issue, giving as many details of operation as can now be printed without disclosing features that the inventor prefers to withhold for the present, for obvious reasons. We believe ourselves that as regards the point of expense, cars equipped with accumulators can be run at least at two-thirds the cost of cars on cable roads, and there is, moreover, the immense advantage that each car carrying its own power is an independent unit, whilst, as we see so often on the Brooklyn Bridge, the slightest accident to the cable paralyzes the whole service, and generally in the hours when the travel is greatest. Another point of significance and that will have consideration is that individual cars can be taken in hand for change, and thus the existing rolling stock be progressively adapted to the needs of the new conditions. This involves a smaller initial outlay and gives opportunity to train the present force in their new work, which, again, has a recommendation for them in being easy to do and less exhaustive physically.

THE discussion continues over the wretched hitch in the arrangements for lighting the Statue of Liberty. Without any wish to speak evil of authorities, and with a full appreciation of the many difficulties involved, we must utter our opinion that the matter has been sadly mismanaged from beginning to end. Among the new suggestions made is that of Mr. L. Stieringer, who, in a letter to the papers, remarks: "The present intense light can easily be shown to be entirely unnecessary to the realization of the idea of a luminous flambeau or beacon, not objectionable to navigation nor interfering with any minor and supplementary effects. An arrangement of lamps of moderate power, so as to produce a structural effect, will be, if desirable at all, as efficacious and visible at as great a distance as is essential. The lighting here demanded is in no sense an embodiment of ordinary light-house practice, and must be accomplished by the aid of distinctively unique methods. Such an arrangement would not necessitate any addition to the present machinery, would greatly reduce the expense of maintenance, need not disfigure the statue either by day or night, and would prove more reliable than any service necessitating an expenditure of such an energy as now required. The light of the present powerful lamps, properly placed and directed, will secure such a general illumination of the figure as will make it one of the most beautiful objects by night, which the artist has imagined. We cannot all make pilgrimages to the near vicinity of the island in a storm, and thus realize the beauty of an illumination enhanced by every falling raindrop, which reinforces, by its reflecting power, the efficacy of the lamps at the base. All that is necessary to secure the same effect, when viewed from distant points, is the proper intensity and color in the torch, and the proper quantity and diffusion from below." Mr. Stieringer has carried out some very large lighting operations for the Edison Company, and might well, we think, be called in to consult. But, first of all, let it be made sure that Liberty is to be lighted. At the worst, she might be given a coat of luminous paint.

ONE of our daily contemporaries, the *Tribune*, published a few days ago an article to prove that in this city, despite the use of electricity as an illuminant, the amount of gas consumed is on the increase. The article is, as a whole, impartially written, and commenting on it is the following editorial: "The holders of gas stock in this city have always wailed plaintively in public when it has been suggested that the price of gas ought to come down, but it is said on good authority that in the privacy of their own homes the directors have never entirely given way to despair. The demand for the light which they dispense grows continually, despite the increased use of electricity; and if their dividends are reduced, the improvement and enlargement of the companies' works do not look like immediate bankruptcy. The fact is that gas still holds its own in New York for illuminating purposes, and if the directors only had the wit to make it cheaper, new domestic uses, such as heating and cooking, would be developed. To claim, however, that gas is better for lighting the streets than electricity is ridiculous." While we will not call into question the accuracy of the figures given, for they seem to be carefully compiled, we are constrained to venture the criticism that the increase in the use of gas as exhibited has not kept pace with the increase of population, in spite, too, of the fact that the more general use of electricity every year on the streets and in public resorts is raising the standard of artificial illumination, and so helping to improve the demand for gas in the thousands of homes where the incandescent light is still an unattained boon and where the gas jets still flicker and bob and give off their harmful products. Perhaps it will be thought by some that electricians are not in a position to speak with fairness as to the relative merits of electric light and other illumination, but it may be affirmed as an absolute fact that every day sees the electric light become better and cheaper, and sees, also, gas companies all over the world constructing electric light plants for public service. The gas companies are about to undertake some very heavy electric lighting. Their qualifications for the work are far from slight.

REVIEWS OF NEW BOOKS.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. III. Published by the Secretary, New York. 162 pp.

The fact that the Institute should already have published its third volume of proceedings ought to convince any one that it has large and varied opportunities of usefulness and deserves the support of every electrician in the country. It is a pity that in America there should be so little disposition on the part of those engaged in electrical investigations and applications to meet for an exchange of opinion and sentiment. The excuse can with some reason be offered that we are all too busily engaged in making history—or money—to find time, as do our European brethren, for periods of recreative discussion; but it must be felt by many that the excuse is not all-sufficient, and that the good to be secured would recompense those who now hold aloof, not from lack of sympathy, but because they believe themselves to be "too busy."

However, as we have said, the American Institute of Electrical Engineers continues to do its work with success, if somewhat unobtrusively, and, without being too sanguine, we may take the appearance of this volume as a hopeful sign of sustained interest and wider membership. Mr. Ralph Pope, the secretary, has done his share with credit, and the papers and discussions have a lasting value. The volume includes: "Underground Electrical Systems," by Sidney F. Shelbourne; "The Great Tangent Galvanometer," by Prof. Wm. A. Anthony; "Some Recent Advances in Telephony," by Thomas D. Lockwood; "The Patent Office and Patent Practice," by A. C. Fowler; "Static Difficulties in Telegraph Wires," by F. W. Jones; "Secondary Batteries for Light and Power," by A. H. Bauer. As is usual, the discussions on these timely topics take a free range, touching on many collateral subjects and side issues, but are as a whole unusually intelligent and full of point. It is to be hoped that during the winter now upon us, the Institute will have papers of equal weight and importance again presented to it, and will keep up the pleasant practice it has started of combining social intercourse with the more solid business of each occasion.

An Improvement in Quadruplex Telegraphy.

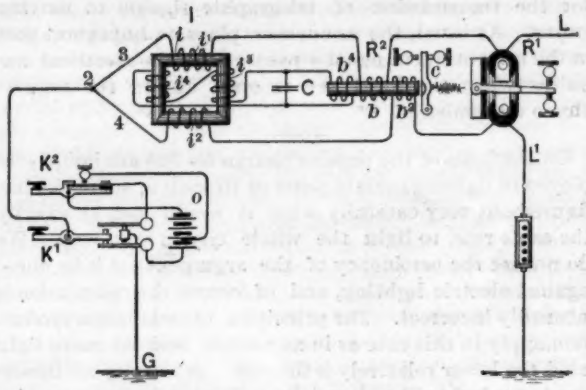
The most serious obstacle to the successful operation of the quadruplex apparatus has been the defect existing in the neutral relay caused by the reversal of polarity of the distant battery, whereby the signals are mutilated on lines of any considerable length. The device of the repeating sounder and others of a similar character, while partially overcoming the defect, prove inadequate when the quadruplex is applied to lines exceeding 300 miles. Especially is this the case when the dynamo current is employed, as it then becomes impossible to use the continuity-preserving pole-changer for reversing the currents, and the style of transmitter adapted to this system increases to a very sensible degree the interval of "no magnetism" in the neutral relay, thus greatly augmenting the difficulty,

In order to overcome this fault and to add to the efficiency of the quadruplex system, Messrs. J. M. Moffatt and Edward Blakeney of the general office of the Western Union Telegraph Company of this city, conducted last spring a series of experiments with the quadruplex apparatus of that company upon lines of various lengths. The result of their labors in this direction is the invention which we illustrate on this page.

The accompanying drawing, which illustrates the invention, shows the general organization of circuits and apparatus embodying the principle. Referring to the figure, L represents a telegraph-main, and K^2 and K', respectively, represent a key for increasing the strength of currents and a pole-changing key for transmitting currents from a battery, O. One pole of this battery is connected with the lever of the key K^2, and when the keys are in the position shown its connections are continued through the key K' to the earth at G. The other pole is connected with the reversing-key K' in a manner well understood. The battery O is divided, as shown, by a conductor leading from an intermediate point to the key K^2, which, when operated, places alternately the whole and a portion of the battery to line through the key K' and a conductor leading to a point, 2. From this point 2, two conductors, 3 and 4, lead, respectively, to the main line L and to an artificial line L'. A differentially-wound receiving-instrument, R', has its respective coils included in the main line L and in the artificial line L'. This instrument is provided with a polarized armature, and constructed in any convenient well-known manner as a polarized receiving instrument or relay.

The second or neutral receiving instrument R^2 is constructed with three sets of coils, b, b', and b^2. The coil b is included in the main line circuit and the coil b^2 in the artificial line. The supplement coil b' is included in an independent circuit, and is employed for maintaining the magnetism of the core of this receiving instrument during the reversals in the main line current. This is accomplished by sending a momentary impulse through the coils b' at the moment of reversal. Such an impulse is derived from an inductorium or induction coil I. This coil is constructed in any convenient manner. For instance, it may be a closed magnetic ring or rectangular frame, i having coils i', i^2, i^3, i^4, wound upon it. The coils i' i^3 are included, respectively, in the main line L and artificial line L'. The coils i^2 and i^4 are connected through the supplemental coil b' of the receiving instrument R^2.

Variations in the strength or reversal of the polarity of the current traversing the line will, it is evident, cause variations in the magnetism of the core, and thus induce currents in the coils i^2 and i^4. The effect of this induced current is to prevent the armature of the neutral relay from falling against the back-stop and remaining there long enough to give a false signal at the instant of the reversal of the current, caused by the operation of the pole-changing key, and this is done in the following manner: When a current in one direction is passing through the neutral relay, it produces magnetism in the core of a certain polarity.



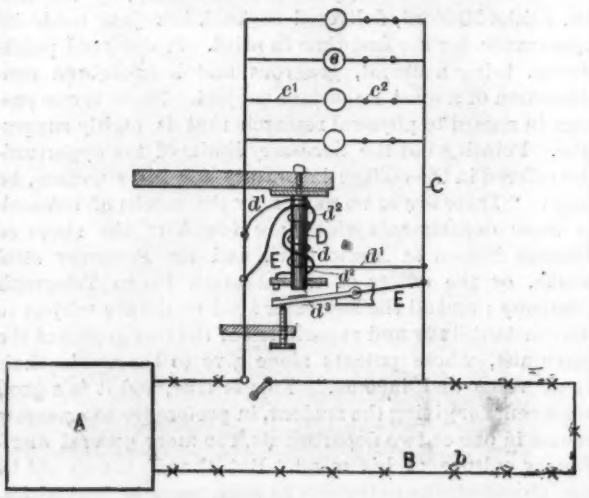
NEW QUADRUPLEX ARRANGEMENT.

When this current is reversed, the magnetism in the core of the neutral relay must first be discharged, and it then charges itself anew with the magnetism of a polarity due to the reversed current. Ordinarily this discharge and recharge occupy time enough for the armature to be drawn by its retractile spring to the back contact and give a false signal. Now, the effect of the induced current referred to is first to aid in the rapid discharge of the magnetism in the core of the neutral, and then immediately to aid in the rapid recharge of the cores with the magnetism due to the reversal of the current. Thus both operations are facilitated by the operation of the induced current, and the time so shortened that the armature cannot reach the back contact, but is held practically without interruption to its front contact.

For the purpose of assisting the operation, a condenser c may be connected across the terminals of the induction coil, as shown, and the discharge from this condenser upon variation or reversals in the magnetism of the induction coil will serve to send impulses of the proper character through the coil b' momentarily. There are several different ways in which the same general result is accomplished by the inventors, but the above will suffice to illustrate their system.

Incandescent Lighting from Arc Circuits.

The method patented recently by Mr. H. P. Brown, of Chicago, for operating and protecting incandescent lights in multiple-arc groups on arc light circuits is illustrated in



INCANDESCENT LIGHTING ON ARC CIRCUIT.

the accompanying diagram. As will be seen, each multiple-arc group of incandescent lamps is provided with an additional branch wire, in which is included a fine-wire or high-resistance helix of an electro-magnet, so that only a small fraction of the total current will pass through it. The armature-lever of this electro-magnet operates to close a short circuit around the group of incandescent lamps when moved from its normal position by the increased attraction of the electro-magnet or its core. The electro-magnet is also provided with a coarse-wire or low-resistance coil, which is included in this short circuit, so that when the short circuit is once closed by the electro-magnet, due to an increase of current in its fine-wire coil, the coarse-wire coil will energize the core and keep the short circuit closed. When all the lamps of the group are in use, the fine wire or high-resistance coil of the electro-magnet, which is in multiple arc with the lamps, only receives its normal amount of current, and the armature or switch lever remains in its retracted or normal position. The moment, however, one or more lamps in the group is extinguished or fails to act, the high resistance coil receives more than its normal share of the current, thus energizing the core and moving the armature-lever to close the short circuit, and thereby cut out the remaining lamps of the group before they can receive any injury from the excess of current. The armature-lever may be adjusted to close the short circuit when only one lamp of the group fails, or not until two or more lamps in the group shall have failed, if the excess of current due thereto in the remaining lamps of the group would not endanger them. The fine-wire and coarse-wire helices are both preferably wrapped around the same core; but they may have separate cores, if desired, and other or equivalent means than the coarse-wire helix may be used to keep the short circuit closed.

In the diagram, A represents the source of electricity; B the arc light circuit, in which may be included in series a number of arc lights, as b, and one or more groups of incandescent lights; C is the incandescent lamp-circuit, in which are included in multiple arc a number of incandescent lamps c, on the branch wires c'. Each branch wire c' is furnished with a switch, c^2, by which the lamp may be lighted or extinguished; D is the core of an electro-magnet, which is provided with a fine-wire or high-resistance helix, d, that is included in a branch circuit, d', like one of the lamps, and is in multiple arc with the lamps; E is a short circuit around the group of incandescent lamps, which remains normally open, and which, when closed, cuts out all the lamps. The electro-magnet is provided with a coarse-wire or low-resistance coil, d^2, which is included in the short circuit E. The armature lever d^3 of the electro-magnet is either a switch or operates a switch which closes the short circuit E, when said lever is moved from its normal position by the increased attraction of the magnet. The helix d is of such high resistance that it will receive only a small fraction of the current when the same divides between it and the lamps, and the helix d^2 is of such low resistance as to offer little obstruction to the free passage of the current through the short circuit.

Extending New York's Electrical Subways.

At the meeting of the Subway Commission last week, Mr. Gibbens took his seat as Mr. Flower's successor. Mr. Hess was elected President of the Board, and resolutions were passed complimenting Mr. Flower on his zeal and success in the work. Engineer Kearney reported that Fifty-eighth street had been chosen for the cross-section from Sixth avenue to the East River, in accordance with the wishes of the Metropolitan Telephone Company. He also reported favorably on the sections from the Brooklyn Bridge to the telephone offices on Cortlandt street, and on the Broadway section from Thirty-fourth to Spring street. Engineer Thomson reported that the section from the Brooklyn Bridge to Cortlandt street and Broadway would consist of 6 iron tubes 3 inches in diameter, 6 of 2½ inches, and 6 additional tubes, the dimensions of which had not yet been decided upon. Mr. Gibbens suggested that the route should extend through the City Hall Park instead of through Mail street, and it was resolved to ask permission from the Department of Parks to use that route. The iron pipes for this section will be here within two weeks. The pipes are to be laid in hydraulic cement if the weather will permit. The commission ordered that the work should begin two weeks from Monday last.

The Fifty-eighth street section was awarded to the Averell Company, on condition that its paper tubes should prove as represented. Dr. Ledoux, chemist of the board, made a favorable report on the material and the tubes submitted to him, but Engineer Kearney required that samples should be sent to him also. General Averell misunderstood the purpose of his request, and declared that he had made any number of tests, and had been ready to work for a year past. The final adoption of the system was put off until the paper tubes arrived. The specifications for the work under the Averell system of prisms were adopted, however.

Engineer Thomson reported favorably on the section of three iron ducts, 3 inches in diameter, from Broadway and Spring street to the North River, as asked for by the Metropolitan Telephone Company to complete their system. These tubes will be laid in an iron box filled with asphalt, and work will be begun on them two weeks from Monday.

Mr. Lauterbach made an application for another section to be laid on West street, between Cortlandt and Liberty streets, the conduit to consist of one iron pipe, 4 inches in diameter, for general use, and one 3 inches in diameter, for the Metropolitan Telephone Company. This was granted. Mr. Gibbens inquired whether the Metropolitan Telephone Company was making any preparations to obey the order of the commission to occupy the Dorsett conduit on Sixth avenue. Mr. Beckwith, representing the company, replied: "We are considering the matter. I cannot say anything more definite to-day."

Mr. Beckwith would not say whether objections would be brought forward against the use of the Dorsett conduits, but there were indications that there would yet be a fight over the removal of poles on Sixth avenue.

As Corporation Counsel Lacombe has given an opinion

that until the streets are disturbed the Department of Public Works has nothing to do with the stringing of wires from housetops, Mr. Gibbens said that although his opinion was unchanged, he did not wish to let a legal technicality stand in the way of the district messenger telegraph companies. The Manhattan District Telegraph Company was then granted a temporary permit, to take effect when applications for special wires should be handed in. When the Business Men's District Messenger Company's application was taken up, Commissioner Moss refused to vote, giving reasons in addition to his determination not to foster any more new overhead wires. The Secretary was ordered to investigate the company and the desire of the people in Harlem to use it. Mr. Moss said he believed the company had been formed simply to sell out its franchises, and the question was tabled.

The Julien Accumulator and Traction System.

There is no question to-day more interesting to the electrician than, and hardly any so important to street railway companies and the urban public as, the application of electricity to the propulsion of tram cars. A critical stage has been reached in the practical development of this latest field of applied electricity, when all that is offered to notice deserves close study. At the present moment, M. Ed. Julien, engineer and electrician of Brussels, is demonstrating in this city the merits of his system of electric traction, and it is arousing unusual attention. We deem it proper, therefore, to give a description, with illustrations, of this system, concerning which some of the foremost street railway men in America as well as in Europe entertain a very high opinion, one that they are preparing to give evidence of in employing the Julien cars on their respective roads.

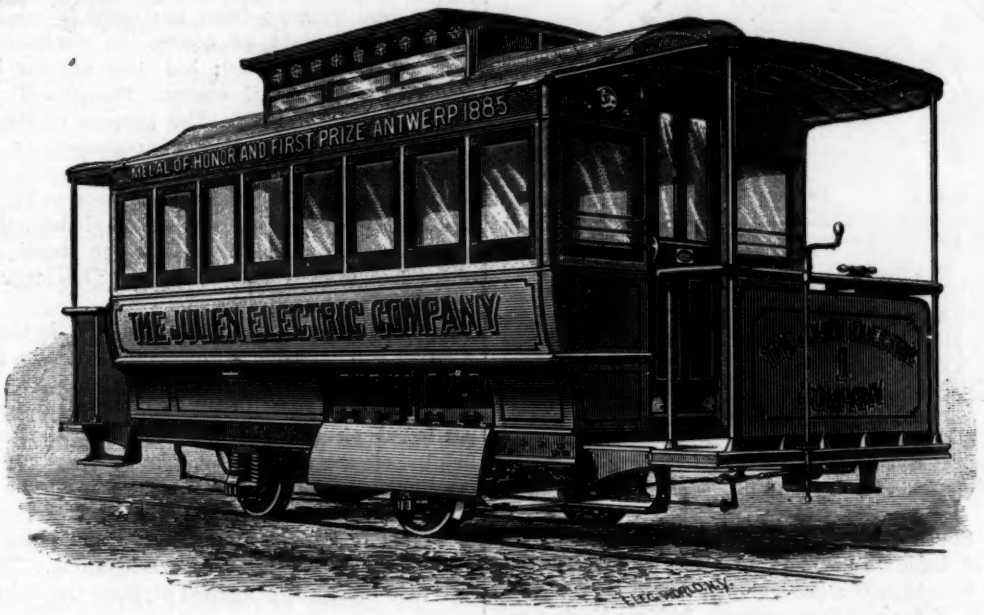


FIG. 1.—THE JULIEN ELECTRIC STREET CAR.

At the outset, it may be remarked that M. Julien occupies in Belgium a position giving him no small authority in the matter of traction. Besides being himself familiar with tramway operation and conversant with all the needs of the industry, he has for several years devoted himself specially to the problems of electric traction, and more particularly to the use of accumulators for the purpose. As far back as 1881, he organized the Compagnie l'Electrique for introducing the Faure accumulators and the Brush electric light system in Belgium; and being thus one of the first to study practically and seriously the employment of accumulators on street cars, he is better able than many to appreciate the advantages, and to eliminate or minimize the inconveniences attaching to their use. At the time that M. Julien began to experiment, the storage battery had fallen into a good deal of discredit that was to a considerable extent justifiable, and that resulted from the instability of the battery. This condition of affairs, observed Mr. Julien, sprang from the production of the plates on a wrong principle, industrially speaking—that of the oxidation of the lead supporting the active material applied to its surface by whatever process, whether decomposition or addition. The result in either case was that when the plate was formed by the action of the current, the positive was more and more deeply oxidized, so that after a relatively short time, if the battery were put into continuously active service, the supporting substance was wholly transformed into peroxide, a material of little consistency or conductivity. In that state the battery was inert and useless, and it became evident that such conditions afforded no hope of profitable occupancy of any industrial field. And this may be said to be the consensus of opinion on the part of all the physicists who have studied the subject since the discovery of secondary batteries, that is to say, since the beginning of the century. Though of interest, it is not necessary for us to enter here into a description of the early efforts and attempts made to construct a practical storage battery, but, on the contrary, we will proceed at once to describe the methods by which M. Julien has achieved success.

M. Julien has followed a principle directly opposite, it is believed, to that heretofore employed, at the same time taking advantage of what had been determined to be proper in the generation of secondary battery currents. After much laborious research, he recognized the fact that by combining different metals, such as lead, mercury and antimony, in certain definite proportions, an inoxidizable alloy is formed which is found to be eminently adapted for use as supporting plates in storage batteries. Attempts had already been made to give the supporting plate greater consistency, and to that end Faure, and also M. Julien, also added antimony to the lead from the beginning of their manufacture, but no attempt had been made to render the plate inoxidizable.

By means of the inoxidizable plate M. Julien has succeeded, it is thought, in removing the old objections to the storage battery, the plates remaining rigid and undergoing no deformation. The active material adheres perfectly to the metal plate, due principally to the nature of the alloy employed. The life of the plates as demonstrated by several instances is a long one, and after nearly two years' use they show no deformation.

Some experiments recently made with the Julien cells by Professor Eric Gérard at the University of Liege, France, under the auspices of the International Commission of the late Antwerp Exhibition, show clearly the results obtained by M. Julien's improvements. The following table shows the result of a test made with 24 of the cells:

Duration of charge	7 hours 33 min.
E. M. F. per cell	2.35 volts.
Average strength of current per kilogramme	1.86 ampères.
Energy absorbed per kilogramme	10,700 kilogrammètres.
Ampère-hours per kilogramme	14.
Duration of discharge	6 hours 48 min.
Final E. M. F. per cell	1.89 volts.
Average strength of discharge per kilogramme	1.74 ampères.
Energy given out per kilogramme	8,600 kilogrammètres.
Ampère-hours per kilogramme	11.83.

This showed a commercial efficiency of 80 per cent. when the discharge was stopped at the point where the cells had fallen to 1.89 volts E. M. F. It will also be noted (by converting into English measures) that the cells were capable of delivering about 5½ ampère-hours per pound of weight.

The accompanying illustrations, Figs. 3 and 4, show the record of a test made with 29 Julien cells furnished to the Edison Company of Paris. The curves were traced by a registering instrument designed by M. Huber for that purpose. The cells weighed 40 kilogrammes each, and were charged at the rate of 15 ampère-hours per kilogr. and gave at discharge 13½ ampère-hours, showing an efficiency of 90 per cent. The discharge lasted nearly 30 hours, during 22 of which no variation of current strength took place, with a fall in potential of only 4 volts.

As regards the life of the batteries already referred to above, it is interesting to note that for more than two years Prof. L. Nothomb, of the War School at Brussels, has lighted his house by means of a battery of Julien cells, which are still in a perfect state. Our readers will also remember that after six months' service on the electric car at Antwerp, and also in the exhibition, the cells were pronounced by the jury testing them to be unchanged.

More than any other application, electric traction has exacted the employment of perfect accumulators. The constructors of secondary batteries have been aware of this fact, and hence, in all probability, it happens that this specific use has been so limited. It is impossible to attempt a traction system without batteries that can be depended upon. The work is the most exacting that a battery can be subjected to. The current drawn off varies every minute, and is always at a strength very high in view of the number of elements employed. The incessant shaking of the car is also a cause of rapid deterioration in ordinary electrodes in which the active material is not highly adhesive. It is necessary also that the battery should be extremely light and should require little attention. All these considerations have been borne in mind, and have, M. Julien thinks, been met in his system.

The first experiments undertaken by M. Julien were made in June, 1881, on French tramways with the Faure battery, being the first known application of the kind, on tramways proper. The car then used differed very little from that now seen in New York. The main object of M. Julien, then as now, was, after having obtained the battery he sought, to get a practical car. In tramway exploitation, it is specially essential that the devices used shall be the simplest, as well as easy of manufacture. This double point M. Julien claims to have reached. Another objective point is the utilization of the existing rolling stock, and that he has also studied out successfully.

The car that is now in operation on the Eighth avenue road is, on a cursory glance, indistinguishable from any ordinary street car of the type familiar in New York streets, and capable of carrying from 70 to 80 people. It was built by John Stephenson for the Vienna Exposition of 1873, and thus by a strange and happy turn of events returns to the place of its departure after 13 years absence. The batteries are placed under the benches; the motor and the running gear are placed beneath the car floor. Under each platform is a regulating apparatus controlled by a hand-lever covered by a circular box. All the mechanism has been devised so as to be easy of operation by men who have had neither electrical nor mechanical training; and this insures the employment of men accustomed to the road and to street car work generally. The operating parts comprise simply the motor, which is connected by rope gearing to a countershaft, and this in turn is connected with the driving axles by link-chain of special contrivance. The armature makes from 800 to 900 revolutions per minute, while the wheels make 100—at normal speed. The car is started up, by turning the lever, without the slightest shock. The movement is, in fact, remarkably smooth and pleasant, and the car can be stopped instantaneously. The rate of speed is controlled both by the number of elements and by manipulation of

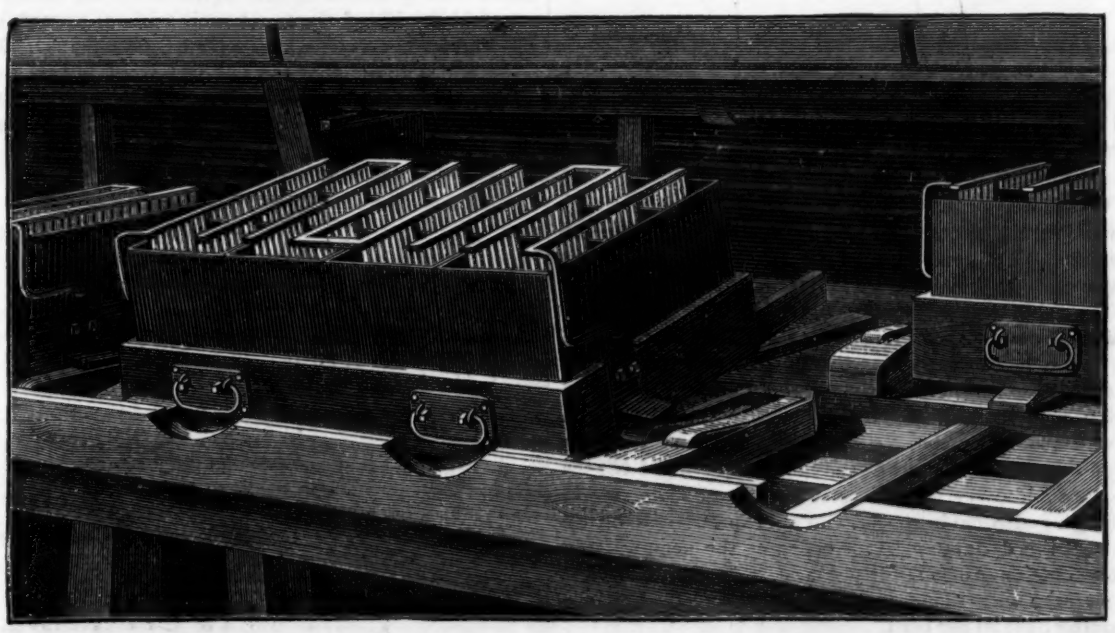


FIG. 2.—THE JULIEN ACCUMULATORS IN STREET CAR SERVICE.

the mechanism itself. It is noteworthy that M. Julien depends in no way upon artificial resistances. The rapidity of movement is controlled by the batteries, and full speed, half speed, full stop, and reverse motion are all obtained by the merest turn of the lever. To the regulator are brought the connections of all the sections of the battery, working alternatively in series and in parallel. All the cells discharge uniformly, and can, therefore, be recharged together. Without this provision, the charging of a large number of batteries would be a matter of enormous complication, if not an impossibility, in a regular service. The motor has an ingenious commutator, rendering attendance and inspection very easy, as well as a simple method of changing the rate of armature rotation. Into details we are not at liberty to enter just now. It may, however, be said that, as a whole, *as a system*, the apparatus is well adapted to the ends it serves. Nothing has been left undone, and all the parts work automatically, rapidly and economically.

The car is well lighted by two incandescent lamps fed by the batteries. The brake is worked by hand, M. Julien considering it unwise to add complication or use up current, by resorting to electricity in this item.

When the car leaves the stable, the recharging of the batteries is effected by means of the benches, on each side of the indoor tracks, as shown in Figs. 5 and 6. The exchange of a charged for an exhausted battery does not occupy more than four or five minutes, and as they are pushed into place, the cells automatically make connection.

Our readers well remember that a highly favorable and flattering report was made relative to the Julien car by the special jury at the Antwerp Exhibition in 1885, when it achieved a notable triumph over several systems and carried off the prize, both on the ground of efficiency and on that of economy. The report of the jury was noticed at great length in THE ELECTRICAL WORLD of March 20, 1886. The jury of 10 comprised representatives of the governments of France, England, Germany and Belgium, as well as a number of experts. The competition lasted from May 3 to Oct. 31, 1885, and was participated in by the Julien car, the Krauss locomotive engine separated from the carriage,

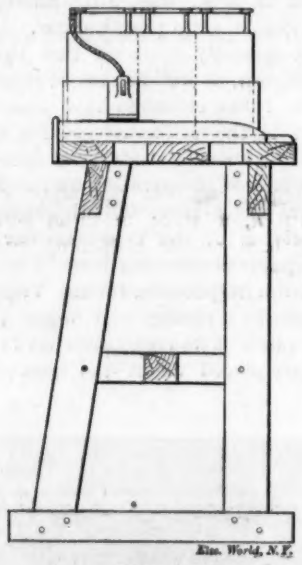


FIG. 5.

the Wilkinson locomotive, also separated, the Rowan engine and carriage combined, and the Beaumont compressed air engine. The report of the jury covered 23 points of comparison, embracing the whole range of operation, and was favorable to the electric car in a most remarkable and significant manner. It was especially noted that the accumulators had been in use prior to the trial, and that at the end of the competition they showed no sign of deformation, deterioration or polarization. The weight of the car was 5,654 lbs.; the weight of the accumulators was 2,460 lbs., and the weight of the machinery was 1,232 lbs. The car could carry 14 passengers inside and 20 outside.

The jury also made special and appropriate note of the fact that the dynamo used for charging the accumulators had an efficiency of only 61 per cent., a figure far below the average with modern machines, American dynamos attaining over 90 per cent.

M. Julien calculates that for a daily run of 100 kilometres, or about 65 miles, at the rate of 6½ miles per hour, it would require about 7½ horse-power per car when run singly, and only 10 horse-power (*i. e.*, 5 h. p. for each) when two cars are run together at the same speed. From this the coal consumption will be easily computable. On the most liberal basis of calculation, the cost with accumulators appears to be far below two-thirds that of cable or horse traction.

So far, as regards the advantage to the street car company. There are also great and direct advantages to the public in the use of the electric car as compared with horses. The service is more expeditious; the streets are less crowded and much cleaner; the motion is easier, and the cars are better lighted. Large stables no longer spread over large blocks required for human occupancy, and the whole change is in the direction of improving the condition of a city. Now that the first steps have been taken, the revolution, for it is nothing else, in methods of urban travel, will go on with tremendous rapidity.

It is not alone in Antwerp that M. Julien has given evidence of the value of his system. In Paris he has cars running daily and regularly between the Palais de l'Industrie et la Place de la Concorde. The awarding committee of the International Exposition of Industrial Arts and Sciences has just given him a diploma of honor, in keeping with that conferred in Belgium. At Hamburg, M. Huber, who holds the right to use the Julien system in Germany, has been running a service since the month of April last, and the two cars have up to date required no repairs. At Brussels, the tramway company is now engaged in equipping to operate one of its lines by the Julien system, after a thoroughly satisfactory trial of two years. The confidence of local capital in the change has been exemplified in the quotations of the stock. Negotiations for control of the system are, it is stated, now pending in London, Paris and Vienna, as well as for Italy, Spain and Portugal. The Belgian papers to hand report that Mr. Hargreaves, a Brazil engineer, who has acquired the

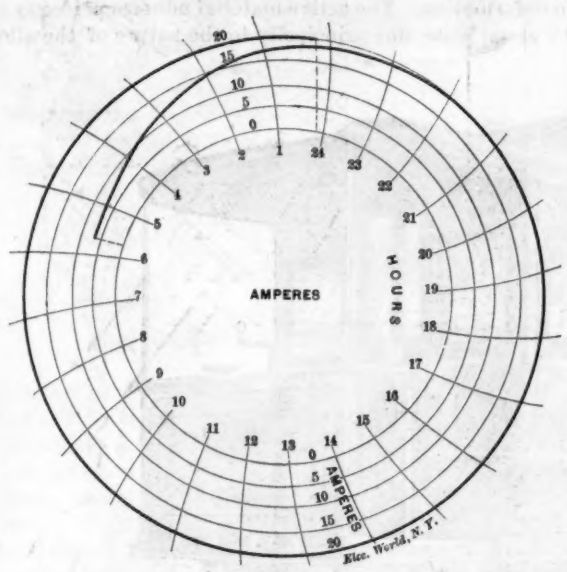


FIG. 3.

rights for South America, is now organizing a staff in Brussels and building his cars to serve as models. The movement is evidently a general one, and deserves attention for that, if for no other reason. In New York a corporation has been formed under the name of the Julien Electric Company, to extend the use of the system all over the United States, and it has now, under the personal supervision of M. Julien, inaugurated the operation of street cars with accumulators, after the manner illustrated by the car described above.

A subject of this nature demands very full treatment, and although we have now devoted considerable space to it, approaching developments will, without doubt, necessitate further and even more exhaustive discussion.

Fig. 1 shows the car now running in New York. Fig. 2 shows a set of accumulators, on the receiving bench in the car stables. Fig. 6 shows a bench without accumulators, and Fig. 5 a bench on which a set has been placed. It will be seen at a glance that the change from horses to electricity, as motive power, can be progressive, and, therefore, far from costly. Thus on a road with 100 cars, 10

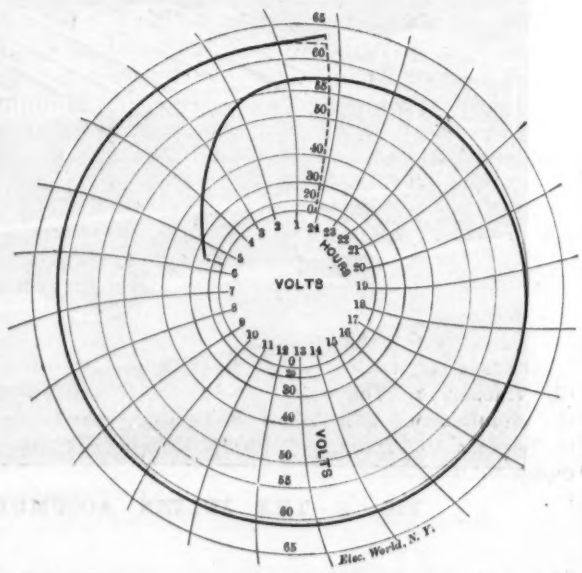


FIG. 4.

can be "changed over" and equipped for the system, and the price for which the 80 or 100 horses rendered unnecessary can be sold will more than cover the initial outlay. This is an important consideration with many, and will have its influence in all probability in bringing about the change more quickly.

Electrical Illumination of Lighthouses.*

BY J. HOPKINSON.

(*Concluded.*)

Various objections may be taken to the arrangements here proposed and collateral points be raised, and it may be convenient to anticipate some of them.

*Paper read before the British Association at Birmingham.

A Dowson gas plant is unsuitable to a lighthouse built upon a rock offering no space beyond that occupied by the tower. True, until there is a paraffin engine burning oils as safe as the oils now used in lighthouse lamps, it is probable that the electric light will be excluded from such stations.

Gas engines and dynamos require a different training of attendants from that which they have acquired with lamps for oil. Again true; but it is also true that starting with fresh men it would be as easy to teach them to manage the electric plant as the highly developed burner now used. Still, no one interested would desire to see the electric light introduced into any service unless the keepers were intelligent and well trained, and the supervision vigilant. Indeed, the electric light should be introduced gradually into lighthouses, though not so gradually as has been the case, giving time for the light keepers and inspectors to gain the necessary experience.

The object of this communication is merely to prove that the minimum cost of an electric lighthouse is not *necessarily* greater than that of an ordinary oil light. The maximum power would not be available if the eight horse engine and dynamo from any cause failed. The engine and dynamo could, of course, be duplicated at moderate cost, about £400; but this appears hardly necessary, as the small engine, though of vastly less power, is still available. The purpose of the larger light is to reduce the number of occasions on which the light ceases to be visible at a stated distance, let us say to reduce it from 50 occasions per annum to 10. If, on some one occasion, this was not accomplished, the mischief would be the same as if on that one occasion the atmosphere had been a little thicker. The large engine is a complete stand-by for the small one.

A question well worthy of discussion is this. In thick weather is it desirable to direct the maximum illumination to the nearer sea instead of to the horizon? The correct answer to this question will undoubtedly depend upon the particular circumstances of each lighthouse, upon the height of the focus upon the sea, and upon whether the light is for the guidance of the maritime traffic and the protecting an extensive reach of coast, or whether it is primarily intended to mark some point of danger, such as the Wolf Rock or the Eddystone. The presumption is in most cases against dipping the light; it implies

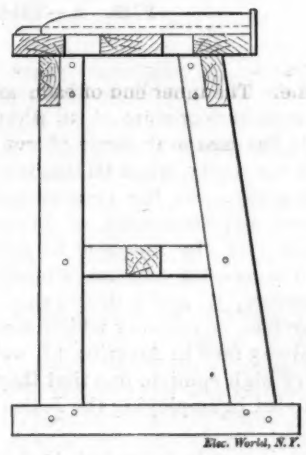


FIG. 6.

robbing the distant sea. The keeper has to exercise his discretion from the appearance of the atmosphere in his vicinity, or in particular directions, and to decide whether it is impossible that the light is reaching its advertised range; if he judges wrongly he may restrict the range of his lights when it is unnecessary to do so. Some guidance may be obtained from the following conditions: With a second order light, and a continuous current of 114 ampères, practically maximum illumination will extend over a vertical angle of about 20′, and over a greater angle the illumination is not much less; we may, therefore, assume that 10′ below the horizon the illumination is as great as in the direction of the horizon, whatever efforts are made to concentrate on the horizon. If the focus be 100 ft. above the water, the sea horizon is distant 11.6 nautical miles, and the range from a ship's deck about 15 nautical miles; but a ray dipping 10′ below the horizon will strike the sea at only 3.2 nautical miles from the lighthouse. If the focus were so changed that the light usually going to the horizon would dip 10′ below the horizon, the light which would usually strike the sea at 3.2 miles, would strike that surface at 2 miles distant from the tower. Probably the wisest solution is to duplicate the larger engine and dynamo, and in actual fog to use both engines and dynamos and both gas producers. The resulting current of 220 ampères not only has the effect of more than doubling the power, but also of increasing to a material extent the vertical divergence. In conclusion, I would repeat the points I seek to establish. An electric light need cost no more either in first outlay or annual charges than a first order oil light of ordinary construction. Economy can be secured by concentrating the machinery used in ordinary weather—*i. e.*, by bringing the engine and dynamo into proximity with the arc. It is a radical mistake to diminish the capital outlay by reducing the focal distance of the optical apparatus.

A New Automatic Current Regulator.

One of the most recent inventions of Mr. C. F. Brush is an ingenious device for controlling and regulating automatically the strength of the current in circuits where it is liable to fluctuations through the switching in or out of lamps, motors, etc., or through variations in the speeds of the armature of the generator. The method and means employed are described below very fully.

Fig. 1 is a view in side elevation of one form of electric current governor embodying the invention, only one of the wire resistances being shown in detail, the remaining resistances being illustrated in dotted lines. Fig. 2 is a detached view, partly in section and partly in end elevation, illustrating by dotted lines the position assumed by the parts of the simultaneous adjustment of the series of contact-rods. Fig. 3 is a detached view in perspective of one of the tubular holders, contact rod, and a portion of the armature. Fig. 4 illustrates the governor applied to the circuit of a dynamo-electric machine for automatically controlling the magnetic field of the machine to govern and control the current in the working circuit.

A represents a frame, which may be made of cast-iron, wood or other material, and of any desired shape and form. It is provided at its upper end with the top portion or forwardly-projecting flange *A'*, from which are suspended the operating parts of the governor. A^2 A^3 are binding-posts secured to the top of the frame, and insulated therefrom by insulating washers A^4. To the binding-posts are detachably connected, by the screws *a*, the ends of the circuit *B*. *B'* represents a long electro-magnet, the opposite ends of the conductor, composing its helix B^2, being permanently secured to the binding-posts A^3 A^3, whereby the electro-magnet *B'* is included in the main circuit and energized by the current flowing therein.

C represents a series of armatures located at a considerable distance below the broad pole-piece *b* of electro-magnet *B'*, in order to insure a practically uniform pull of the magnet on the armatures throughout their entire range of movement, and thereby cause a slight increase or correspondingly slight decrease in the strength of the magnet to attract or release the armatures. The armatures are each supported, as represented in Fig. 2, on a strip, *C'*, of wood or other insulating material fastened to the frame underneath the ledge C^2, which latter is formed on the frame itself, the strip *C'* and the ledge C^2 being located at such a distance apart as to form a groove within which the ends of the armatures are inserted. The insulating strip C^3, fastened to the under side of the ledge C^2, operates to insulate the armatures from the frame. The inner end of each armature is provided with a hole or depression c^2, in which is received a pin or stud c^3, fastened to the strip *C'*, which serves to retain the inner end of the armature against lateral or endwise displacement, and allow the armature to be supported on the edge of its downwardly-curved rear end and rock thereon, and thus be subjected to only the minimum amount of friction in its operation. The outer or free ends of the series of armatures rest on a bar or strip *D*, of wood or other insulating material, and hence are retained at an equal distance from the pole of the magnet *B'*, and are retained against lateral displacement by the guide-pins d^2. The bar or strip *D* is journaled between the depending arms *d* of the bracket *D'* by the pivotal bearing D^2, to allow the strip to be slightly rotated on its axis for a purpose which will be hereinafter explained. To the free end of each armature is fastened a depending tubular holder *E*, which is closed at its lower end, and contains in its lower portion a spiral spring *e*. Within the holder is inserted a contact piece or rod *E'*, which is preferably made of carbon. Contact-piece *E'* is a straight rod, preferably cylindrical in cross-section, and loosely fits within the tubular holder and rests upon the spiral spring *e*, contained therein. That portion of the tubular holder extending above the armature is cut away so as to forming a semi-circular bearing *e'*, against which rests one side of the projecting end of the contact piece or rod *E'*.

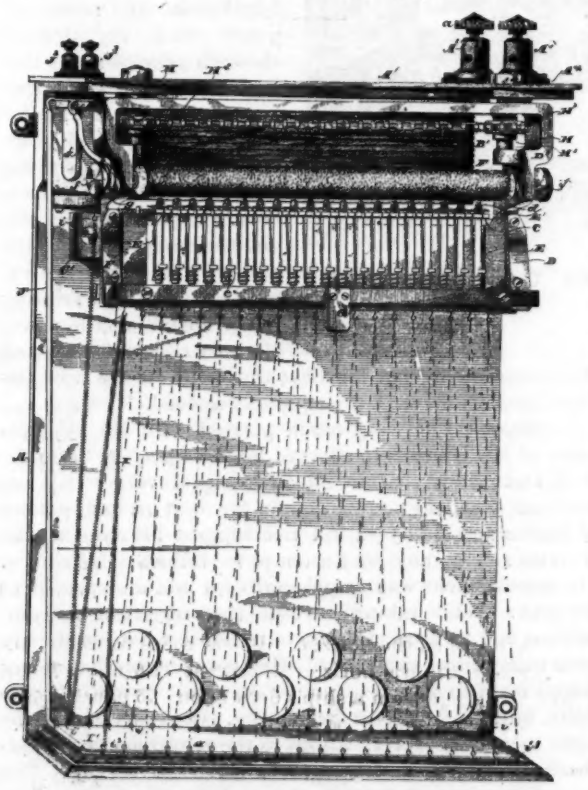
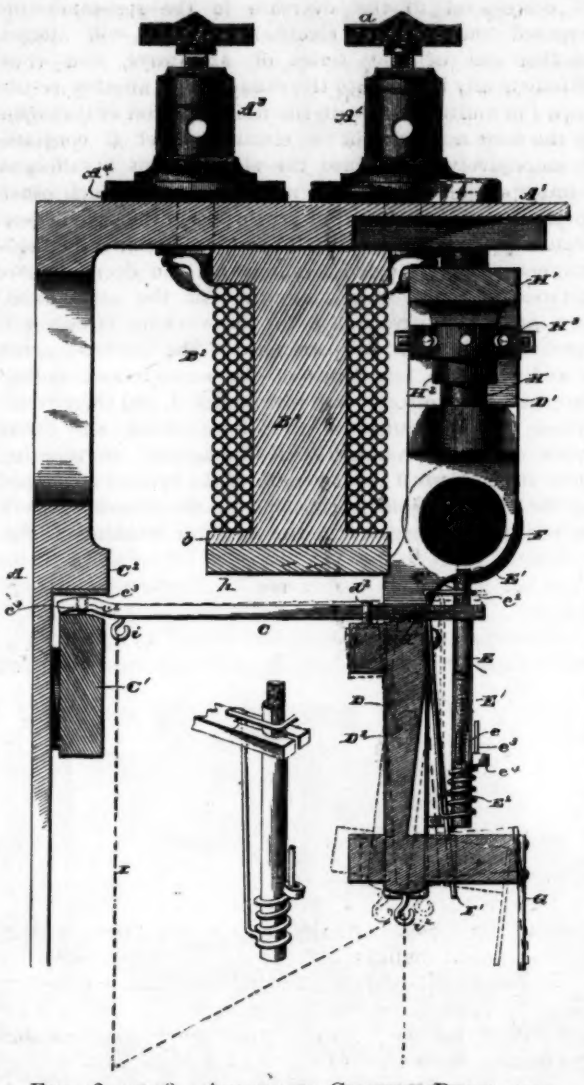


FIG. 1.—AUTOMATIC CURRENT REGULATOR.



FIGS. 2 AND 3.—AUTOMATIC CURRENT REGULATOR.

To the lower portion of the tubular holder is secured one end of a wire spring E^2, which extends upwardly and passes through an elongated slot in the armature, the upper end of the spring being bent laterally and then forwardly and round in front of the contact-rod, the straight end e^2 bearing against the contact-rod and forcing it into contact with its semi-circular seat or bearing *e'*. The spring E^2 is sufficiently strong to force the contact-rod against its seat or bearing *e'* with sufficient force to securely clamp the contact-rod and retain it in its proper adjustment. On each tubular holder is fastened a hook, e^3, on which is suspended a weight, e^4, for the purpose of adjusting the armature, so that it will respond to a predetermined pull of the magnet. Above the series of contact rods is located a rod, bar or cylinder, *F*, which is preferably made of carbon, although any other suitable electric conductor might be used for this purpose. Carbon is the preferred material for the series of contact-rods and the main contact bar or rod *F*, because of its well-known refractory qualities, conductivity and cheapness.

The rod or cylinder *F* is journaled at its opposite ends on adjustable screw-points *f*, so that it may be easily removed when necessary, and may be readily rotated so as to present a fresh surface for the series of contact-rods to engage with whenever any portion of the surface of the cylinder becomes uneven or unduly worn or burned away.

As above stated, the bar or strip *D*, on which rest the free ends of the series of armatures, is journaled between the brackets *d*. The object of this is to provide for the simultaneous adjustment of all the contact-rods of the series, which result is effected as follows: By pressing on the thumb-piece *G*, attached to the lower edge of the strip or bar *D*, and moving the lower edge rearwardly, its upper and forward edge *G'* will be moved forward and engage each one of the spring-arms E^2, and simultaneously retract the entire series, and thus operate to release the clamping arms or fingers e^2 from their contact-rods, as shown by dotted lines in Fig. 2, and allow the contact-rods to be forced upwardly by their spiral spring supports within the holders into contact with the main contact-bar or cylinder *F*. This operation is quickly performed and simultaneously adjusts the contact-rods so that their outer ends will be in alignment with each other; or, in other words, the main contact-bar *F* forms a straight and an even gauge against which the ends of the several contact-rods are forced simultaneously, and thus brought into perfect alignment with each other. The position of the parts in effecting this operation is illustrated in Fig. 2. The next operation is to simultaneously separate the contact-rods a very slight but a uniform distance from the main contact-rod or cylinder *F*, which is effected as follows, reference being had to Fig. 2. After the spring-clamps have been retracted and the contact-rod clamp disengaged by the action of the edge *G'* of the oscillating bar or strip *D*, the lower edge of the latter is pulled outwardly, as shown by the dotted lines i Fig. 2, which operates to move the upper edge rearwardly, and causes the forward edge, *G'*, to engage the under side of all the armatures and lift them a slight distance, as represented by dotted lines in Fig. 2, the effect of which is to slightly raise each one of the tubular holders and contact clamps carried thereon, and, as the ends of the contact-rods rest against the cylinder *F*, they will be held stationary while the tubular holders are raised, and hence the several clamps or arms e^2 will each be moved upwardly on its contact-rod and form a new point of engagement therewith. This having been done, the edge *G'* of the bar or strip *D* is moved outwardly again, allowing the armatures to descend and carry with them their contact-rods, and thus separate the ends of the latter a very slight distance from the surface of the main contact bar or cylinder *F*. As all the armatures are moved exactly the same distance in effecting the adjustment of the contact-rods, the ends of the latter will all be equally distant from the main contact cylinder. Springs *F'*, attached to the bracket-arms, engage the adjustable strip or bar *D*, and prevent it being accidentally displaced. The distance of separation between armature and pole-piece may be varied as occasion may require by the following means: The electro-magnet is preferably secured in a permanent manner to the top *A'* of the frame. The bar or strip *D*, which serves as a support for the outer or free end of the armatures, is journaled in the arms of the bracket *D'*, which latter is made vertically adjustable in the following manner: To the top of the frame are secured the screw-rods *H*, one at each end, which extend downward and form guides to the cross-bar *H'* of the bracket, thereby enabling the latter to be vertically moved thereon. On each one of the screw-rods is placed a nut H^2, the periphery of which constitutes a sprocket-wheel H^3. An endless chain H^4 engages the two sprocket-wheels H^3. By moving the chain in one direction, bracket *D'* is raised and the series of armatures moved toward the pole of the electro-magnet, and by moving the chain in the opposite direction the bracket is lowered and the armatures are moved away from the pole of the magnet; hence all of the armatures of the series may be simultaneously adjusted with relation to the pole-piece of the electro-magnet, which adjustment is convenient to adapt the apparatus to the automatic control and regulation of electric currents of different strength. On the pole-piece of the magnet is secured a strip *h*, of wood or other suitable insulating material, which serves as a spacing-strip and as a stop for the armatures.

I I represent resistances, only one being illustrated in Fig. 1, the others of the series being represented by dotted lines. Each one of the resistances is preferably composed of fine German silver wire, which is first coiled into a spiral and then stretched, one end of the wire being attached to a hook *i*, fastened to the pivoted end of the armature, from which point the wire is carried down and attached to a hook *i'*, fastened to the insulated bottom *I'* of the frame, and from thence the wire is carried upward and attached to a hook i^2, fastened to the strip or bar *D*, and from thence it extends downward, and its opposite end is fastened to a hook i^3, secured to the bottom piece *I* of the frame. All of the hooks i^2 are soldered to or otherwise electrically connected with the copper wire *J* or other suitable electrical conductor.

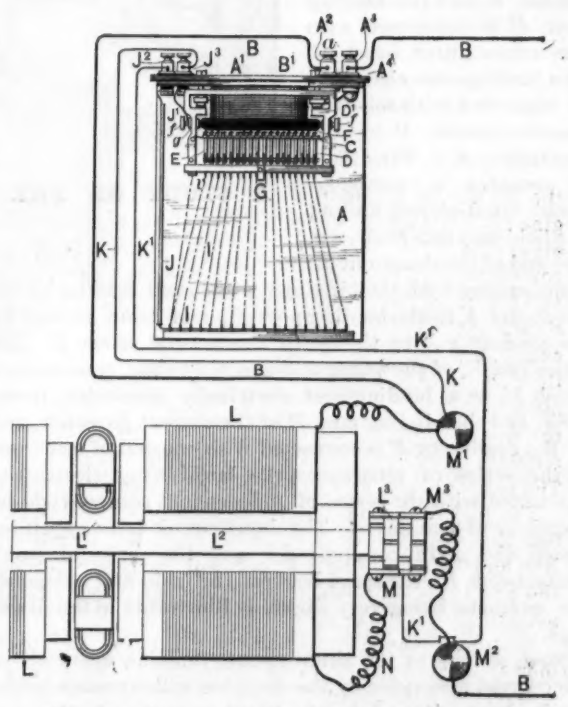


FIG. 4.—AUTOMATIC REGULATOR IN CIRCUIT.

By making the resistance in the spiral form and stretching the spirals, and then fastening them as shown and described, several advantages are secured. When the resistances become heated and expanded, the spring action of the spiral conductors operates to take up and

compensate for the slack in the wire, and prevents it from sagging and making contact with the frame or any other one of the resistances of the series. Again, by winding the wire into the form of a spiral, and then stretching it as described, a great length of wire is disposed within a comparatively small space, and each coil is subjected to the cooling action of the air, and thus the heat generated in the resistance by the current is rapidly radiated. The zigzag arrangement of the resistances also allows the apparatus to be brought into comparatively small compass, and thus it requires but little room.

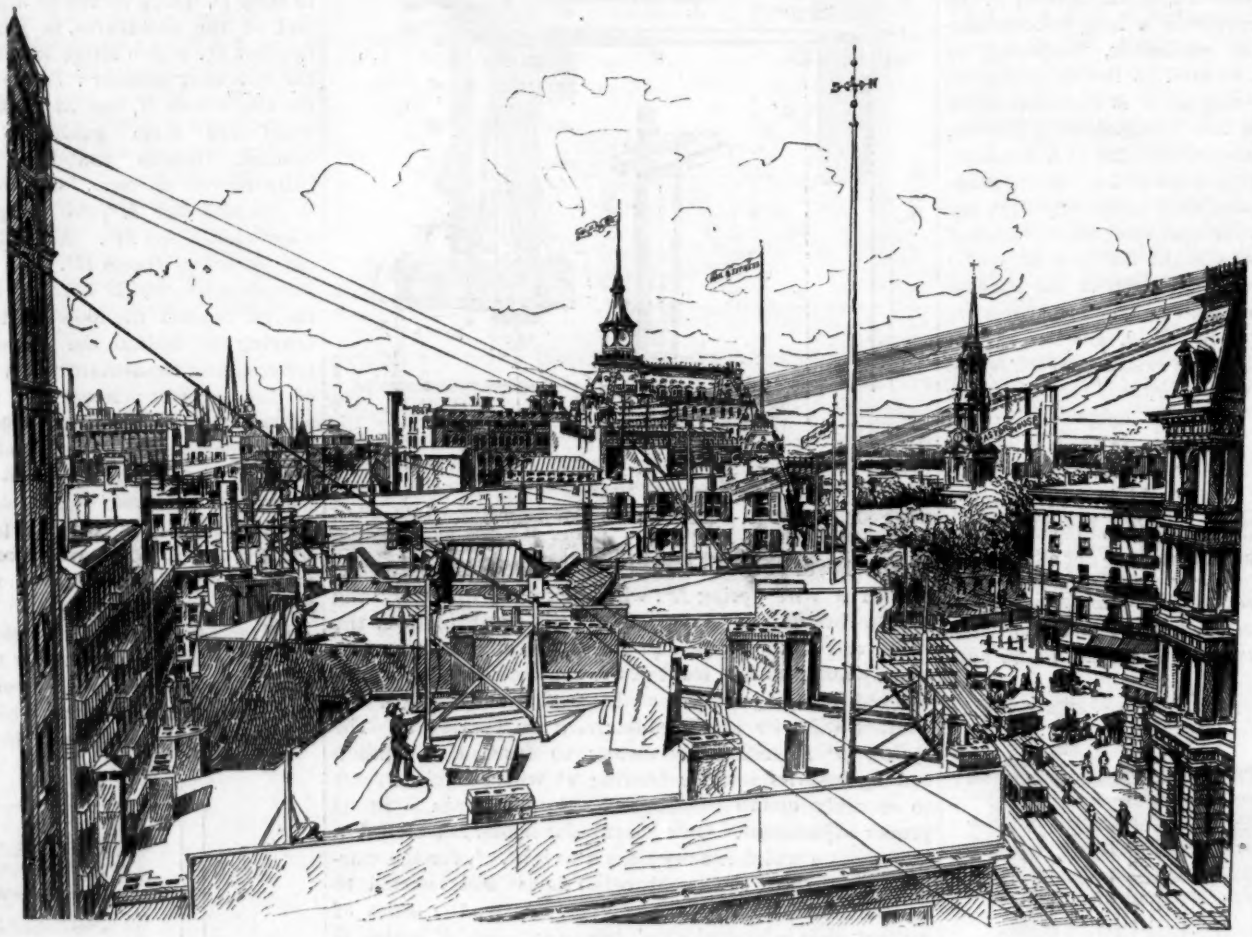
The conductor *J*, with which is connected one end of each resistance of the entire series, is electrically connected with the conductor *J*, which leads and is permanently secured to the binding-post J^2, while a conductor *J'* is connected at one end to the binding-post J^3, and its other end is connected to the pivotal screw *f*. Both of the pivotal screws *f*, which support the main contact cylinder or rod *F*, are insulated from the bracket by the insulating-washers *g*. Thus it will be observed the conductor *J* is electrically connected with one end of each resistance of the entire series, while the conductor *J'* is electrically connected with the main contact-bar or cylinder *F*.

We come now to the operation of the governor in practice. In Fig. 4 the improved current governor is shown included in the circuit of a dynamo-electric machine. *L* represents the field-of-force magnets of the dynamo; *L'*, the armature: L^2 the armature shaft; L^3 the commutator. The helices of the field-magnets are connected in series, one end of the conductor *N* being connected with the commutator brush *M*, and the other end to the binding post *M'*, which forms one terminal of the machine. The other binding-post or terminal M^2 is connected with the other commutator brush M^3. To the binding-posts or terminals *M' M²* are connected the two ends of the external or working circuit *B*. In the working circuit is included the current governor, the circuit being severed, and the ends secured to the binding-posts A^2 A^3. As the ends of the helix of the electro-magnet *B'* are connected to the binding-posts A^2 A^3, the electro-magnet *B'* will thus be included in the main circuit and energized by the current flowing therein. The binding-post J^3 is connected with the binding-post or terminal *M'* by the conductor *K*, and the binding post J^2 is connected with the commutator brush *M*, or a binding-post electrically connected with the commutator brush *M* by the conductor *K'*. Thus there is provided a normally-open shunt-circuit around the field-magnets as shown, one end of the shunt-circuit commencing with the binding-post *M'*, and leading by the conductor *K* to the binding-post J^3, and from thence by the conductor *J'* to the main contact-rod or bar *F*. The other end *K'* of the shunt is connected to the commutator brush *M*, or a binding-post electrically connected therewith, and the binding-post J^2 of the current governor, and by the conductor *J'* is connected with one end of each one of the series of resistances, the latter being electrically connected with the series of independent contact-rods by the series of armatures. The shunt-circuit is thus open between the main contact-rod *F* and the series of small contact-rods *E'*, the space between the main and independent contacts being very slight, as illustrated in the drawings.

Now, so long as the shunt-circuit remains open, all of the current generated by the machine will circulate in the external circuit and in the field-magnets of the machine; but in the event that the resistance in the working circuit is diminished for any reason—as, for instance, by the switching out of electric lamps, motors, or other translating devices therefrom—the current in the main circuit becomes abnormally strong, and operates to correspondingly augment the strength and pull of the electro-magnet *B'*, which in turn attracts the series of armatures. As it is a mechanical impossibility to construct and arrange a series of armatures so that all will respond to exactly the same pull of the magnet, or so that all will be exactly equal in sensitiveness, it follows that when the electro-magnet *B'* is energized it will cause the most sensitive armature of the series to respond and be raised, and thereby cause its contact-rod *E'* to engage the main contact-bar *F*, the effect of which is to close the shunt-circuit around the field-magnets through one of the resistances *I*, and thus divert a portion of the current developed by the dynamo from the field-magnets, the amount thus diverted or shunted away from the field-magnets being proportioned to the relative resistance of the shunt and the main circuit. Should the amount of current thus shunted be insufficient to weaken the field magnets enough to decrease the current strength in the main circuit to correspond to the decrease in the resistance interposed therein, the electro-magnet *B'* will attract another one of the series of armatures, and thus automatically throw into the shunt-circuit another resistance *I* in multiple arc with the resistance first switched in. In the same manner will the electro-magnet *B'* continue to successively throw into the shunt-circuit a sufficient number of the resistances in multiple arc with each other to divert such an amount or proportion of the current generated by the machine as will operate to weaken the field-magnets to a point corresponding with the decreased resistance in the working circuit. On the other hand, any increase of resistance in the working circuit will operate to decrease the strength of the electro-magnet *B'* and cause the armatures of the series to successively drop and open circuit the resistances *I*, and thereby increase the resistance of the shunt-circuit and divert more current through the field-magnets, augmenting their strength until the strength of the current developed by the machine shall correspond to the increased work or resistance interposed in the main or working-circuit.

In view of the fact that each one of the resistances of the series may be of any fixed or predetermined electrical resistance, and that any number of such separate resistances may be arranged to be thrown into the shunt-circuit around the field-magnets in multiple arc with each other, and, further, that the armatures and contacts for automatically switching the resistances into and out of the shunt-circuit are constructed and arranged to be actuated by slight fluctuations in the strength of the current in the main or working circuit, a practically uniform volume of current is maintained in the main circuit, although the resistance therein is greatly varied, either by an increase or a decrease of work interposed therein.

By manipulating the governor in the manner hereinbefore described, all of the series of contact-points or rods may be simultaneously and uniformly adjusted with respect to the main contact-bar, and, as before stated, the main carbon-bar can also be revolved when it is necessary to present a new surface.



A STUDY OF THE AERIAL WIRE QUESTION FROM THE WINDOWS OF "THE ELECTRICAL WORLD."

A Window Study of the Aerial Wire Question.

In resigning his office as President of the Subway Commission, Mr. R. P. Flower felt himself justified in calling the attention of the Governor of this State to the fact that he had actually succeeded in getting *one mile* of wire into conduits. The achievement may seem small to many, and is so intrinsically, but it has significance as showing that the work has begun. How long it will be before all the wires along the leading thoroughfares are buried is a question we cannot undertake to answer. Suggestions as to the magnitude of the task are to be found in such a view as that which may be taken from one of the windows in the office of the business manager of THE ELECTRICAL WORLD, in the Potter building. The immediate foreground is filled up with wires in the manner faithfully shown in the accompanying illustration, taken from a photograph. On the right hand is the post-office, with which large numbers of wires connect from housetop fixtures along Park Row. To the left is Temple Court, and the wires from that building serve to fill up the adjacent roofs down the alley. Along Park Row, through to Broadway run large poles with hundreds of wires and below them come the electric light wires. In short, the view comprises telegraph wires, telephone wires, lighting wires, time wires, district messenger wires, "ticker" wires, special wires belonging to the various newspaper offices, and wires for fire-alarm and police telegraphs. We will not venture any calculation as to the time it will take to put all these wires into subways, but will leave our readers, with this sample of aërial construction before them, to form their own conclusions, not simply with regard to Beekman street and Park Row, but in respect to the whole city. One thing is certain,—the Subway Commission needs to be terribly in earnest.

Mr. Flower on his Resignation.

It having been asserted in some of the papers that Mr. R. P. Flower proposed to make money by handling "subway" stock, he has addressed the following communication to the press:

"I see in the columns of to-day's papers that I am charged with resigning from the office of Commissioner of Subways for an ulterior purpose, namely, to handle and make profit from the stock of companies affected by the law under which the commission is organized, though I fail to remember anything in my past life which would justify such a damaging supposition in regard to me. It is stated "on good authority" also that before resigning I had made arrangements by which my successor was to be my private secretary, so that there would be no miscarriage of the speculation in which I am charged with engaging. I desire to deny these reports as entirely without foundation, and assure the public and my friends through your columns that such ideas never occurred to me until I read that I was carrying them out. My only objects in serving upon the commission have been the good of the city and the carrying out of the will of the people as expressed by the laws relating to the burial of the wires. My only reason for leaving the commisson is that I believe those objects are now insured and my services are no longer needed.

"Although I am very much pleased with the appointment of Mr. Gibbens to succeed myself upon the Commission, and believe that in selecting him Governor Hill has made an excellent nomination on the best grounds—those of fitness and ability—I did not suggest his name to the Governor or in any way attempt to influence his choice. The appointment was as unsought for and unexpected as my own. While taking leave of the subject of the commission and its work, I desire to reiterate what has already been many times explained. The commission has never bound itself to any peculiar or especial system of conduits, but, as its report will show, reserves to itself the right to suit its specifications to the requirements of particular localities and particular electrical service. The commission has not left anything undone to secure the best interests of the city after its term of office expires, but has provided particularly by a contract which cannot be avoided, for every emergency, even should the Legislature fail to extend the period of existence or provide for successors to the Commissioners."

The Telephone on German Railways.—From a report recently issued we gather, says the London *Electrician*, that the telephone has come into extensive use upon the German railways. No less than 33 companies have given it a trial; the results are, as a whole, satisfactory, but it has not been found practicable to rely entirely upon the telephone for signaling service, except upon lines where the traffic is very slight. On busier lines the telephone has proved to be a valuable supplement to the telegraph equipment, and in the large stations it is extensively used to connect the various offices and departments. Altogether nearly 30,000 kilometres of telephone wire have thus been erected.

A Decision at Cincinnati Against the Government.

At Cincinnati, on Nov. 11, a decision was announced in the United States Circuit Court on the question of jurisdiction in the matter of the proceedings brought by the government to annul the Bell patents. It was against the government upon every point which counsel had raised. The bill was dismissed, but without prejudice, which leaves the government in the same position it was before the suit was brought, except that if another suit is brought it must be in Massachusetts, the home of the Bell Company.

The hearing, it will be remembered, was before Circuit Judge Jackson (late United States Senator from Tennessee) and District Judges Sage, of Cincinnati, and Welker, of Cleveland. The question of jurisdiction was raised by the defendant company, by a motion to quash the marshal's return, and a plea in abatement. The hearing occupied five days, and occurred in September. Some remark was excited at the time among members of the local bar on account of the difficulty which the court, in permitting so protracted a discussion, seemed to confess it found in a question usually disposed of in an hour. It is now alleged that it was the peculiar position in which Judge Jackson found himself placed which prompted the careful deliberation which the question has received. Judge Jackson owes his appointment to the present administration, and the annoying report had gone out that the government believed it could rely on him in the telephone suit. He came to the hearing, it is said, with a strong conviction that the suit should not have been brought in the jurisdiction, but fearing that he might have been in some measure led to adopt such an opinion by the unwarranted reports that he was owned by the administration and must entertain the suit, he was particularly anxious to hear all that counsel might have to say. It is further stated that both Judge Sage and Judge Welker entered upon the hearing with the impression that the case was not properly brought at Cincinnati.

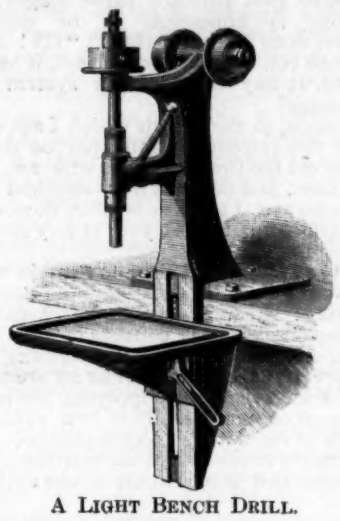
The opinion was written by Judge Jackson and read by Judge Sage. It covered 52 closely written legal cap pages of type writing. The verdict of the attorneys who heard it was that it is a careful and clearly stated review of the propositions presented, and that the reasoning is forcible. It is the impression in Cincinnati that there will be nothing further heard of the case in the courts. It is stated that the government is averse to presenting the case to a Massachusetts court, and, were the feeling otherwise, it would not be possible now to get a hearing before the presentation of the whole group of telephone cases, which have recently been advanced on the docket of the United States Supreme court, and which will be heard in January. The only step that can he taken with reference to the case which has been dismissed would be to go to the Supreme Court on mandamus to compel a hearing of the case in the Cincinnati jurisdiction. Counsel for the government are said to have contemplated such a course in the event of a decision for the Bell Company, but as matters now stand it is not thought here that such proceedings will be instituted. The suit still stands as to the local telephone companies, and a plea in abatement as to them will be presented in December. It is thought that it can be easily maintained.

The law as to jurisdiction, as disclosed by the opinion, is as follows: Where the facts appear upon the face of the papers, a motion to quash the service will reach the case for the purpose of determining the question of jurisdiction; where the facts do not so appear, resort should be had to a plea in abatement, raising an issue which may be tried. In this case, the motion raised the question of personal service, and the plea the question of constructive service. Under the allegations of the bill and the recitals of the marshal's returns (the service was upon the presidents or vice-presidents of a number of Ohio telephone companies), it was held that there was no valid service, either personal or constructive. The fact that the American Bell Telephone Company owns the telephone instruments which are in use in Ohio, it was held, does not give that company a business residence in that State. The furnishing of means to carry on business does not of itself constitute a carrying on of business. A State's corporation does not cease to be a State and become a National corporation by becoming the owner of a patent granted by the general government. While ownership might create a partnership liability, service upon the local officer might be good in controversies as to partnership affairs, but could not be held good in a controversy with an individual partner in another State.

A Large Storage Plant.—The Prudential Assurance Company's offices in London have 1,500 incandescents, to be shortly increased to 2,000. The plant comprises two Compton and two Siemens machines, driven by two horizontal Marshall engines. For storage there are 528 E. P. S. cells. The installation was made by the Electrical Power Storage Company, of London, through Messrs. Drake, Gorham & Edlin.

A Light Bench Drill for Electricians.

Owing to the increasing use of tools and machines by electricians, it has been found expedient to study their wants more closely than heretofore, thus recognizing the close connection between electricity and mechanics. One



A LIGHT BENCH DRILL.

exemplification is found in the light bench drill herewith illustrated, lately made by E. E. Garvin & Co., of this city. It is intended to be fastened to the edge of a bench or table, as represented. There is another style of the same drill, made to be fastened to the wall or a post. The spindle is driven by 1¼ inch belt direct from the countershaft. These tools are especially adapted for drilling small work, up to $\frac{5}{16}$-inch hole, in large quantities, as required in light electrical manufacturing, and several can be grouped in a very small space, in which case they are driven from one long shaft with friction clutch pulleys. The table is provided with a fixed wrench for adjustment. There is an adjustable stop on the upper end of the spindle to regulate the depth of hole. The countershaft accompanies the drill. The weight, when complete and boxed, is about 150 pounds.

A CABINET COMBINATION BATTERY.

A Cabinet Combination Battery.

We illustrate on this page a large and very fine cabinet combination battery, recently manufactured by the Galvano-Faradic Manufacturing Company of this city. Either the Leclanché disc or gravity battery is used for the continuous current. The accessories, arranged on a highly-polished hard-rubber base, consist of current selectors, an automatic interrupter for the galvanic current, polarity changer, faradic coil with rheotome and slow vibrator, a water rheostat and milliampère-meter. The case is of black walnut, elaborately finished, with cylinder cover and glass front. For a physician with large office practice, or for general hospital use, it would be hard to find anything more complete or desirable.

Electricity as Applied to Tramway Service.

At the last meeting of the Electrical Section of the American Institute on Nov. 10, Mr. G. W. Mansfield's paper on electricity as applied to tramway service was read again by special request. In this paper Mr. Mansfield, who has been associated with Mr. Leo Daft in much of his pioneer work in the motor field, gave able expression to some of the opinions at which he had arrived as the result of experience in regard to the use of electricity for locomotive purposes. He did not believe that the overhead conductor system for connecting the cars with the central station will ever be used in large cities, and pointed out that in spite of some advantages its successful operation depends greatly upon "the leniency of the authorities." It was best adapted for small towns of from 5,000 to 10,000 people. Under ordinary circumstances, too, he considered the use of the rails for conductors as impracrical. "We not only have the danger from shocks, but also liability to frighten horses arising from sparking and scintillation of light caused by poor contacts. Again the loss of current due to leakage in most localities would be excessive." Coming to conduits, he said: "Here again we have many advantages and yet disadvantages. The construction of a conduit is different from running a line of poles, yet the arrangement of circuits is practically the same. There is no question but that the difficulties of obtaining firm supports for the insulators and to withstand the tension of the wire would disappear, thus rendering not only the straights but the curves and grades and terminal facilities a more simple problem to solve. Furthermore, from an æsthetic standpoint, you would be gaining. You would have a clear, clean street. The position of the conduit is another important consideration. It could be placed anywhere between or under the rails." As to conduit insulation, Mr. Mansfield remarked: "Regarding the vital point of insulation, more difficulties present themselves than with the overhead. As insulation is inversely proportional to the number of insulators, by utilizing the opportunities of having heavy and strong insulators and placing them as far apart as the conductor would permit, the loss could be reduced to a minimum. * * * It is undoubtedly true that more care would be necessitated, due to gathering of moisture, yet it is but a question of construction and inspection. * * From snow and ice the conductor underground is exempted, but floods must be met by observing proper structural relations." Mr. Mansfield figured the cost of an electric conduit as at least 10 to 20 per cent. greater than overhead service, and at least 30 per cent. cheaper than a cable conduit. He preferred conduit service, direct, to the use of accumulators, as he considered the latter to be still unreliable and extravagant in first cost and maintenance, as well as in return on prime power. "The whole system," he said, "while presenting some novel features, is more fascinating than practical. It probably has its field, or one that it will occupy." On the point of transmitting motor energy to driving wheels, he thought that in time tramways would reach the stage when all gearing would be dispensed with, and the armature be fixed to the driving axle. He held, too, that the car-builder should construct for the motor. "Obviously all cars now out, if equipped, will need radical changes in the floor framing." He thought too that separate motors drawing cars had but a limited range of use in street service. As to types of motors, the plain series was decidedly the best. "You have simply to wind your fields with a number of sections, connect them *seriatim* and cut them out as you wish to increase your power. Evidently the primary must be able to stand the maximum current, and energize the field for the ultimate capacity of the motor. A well-proportioned motor ought to propel your car slowly or rapidly without any undue heating or loss of energy. It takes time and ability, and the electrician who designs the machine can wind his coils and give you the speed of the car on level or grades with each combination of field sections—providing, of course, that the generators supply the current at approximately even potential." Respecting the growth of the business, Mr. Mansfield said that within the last four years much careful work had been done. Where there then was not an electrician in the country who would venture on the total equipment and operation of a fair sized line, there are to-day half a dozen hankering after the opportunity, while contracts innumerable are floating about. The Daft Company, he stated, had now carried over half a million passengers in street cars and had recorded a mileage of nearly 80,000 miles.

Mr. Daniel L. Gibbens, the new subway commissioner for New York, is a young man, probably about thirty years of age. Mr. Gibbens was Mr. Flower's private secretary during his term in Congress, and received the appointment of counsel to the Subway Commision about the same time that Mr. Flower assumed the presidency of the board. In that capacity he has discharged arduous and trying duties with credit.

Incandescent Lighting from Arc-Light Circuits.*

BY FRANK RIDLON.

It is a trite saying that "Electricity is still in its infancy." Although not original, the remark is true. Every day we hear of new developments. Hearing by electricity is familiar enough, seeing by electricity is possible already as a laboratory experiment, and it has been suggested that a further annihilation of space is possible, and that one will be able to eat and drink by electricity—all that will be necessary will be to "call up" Taft's of the Vendome or Delmonico's or Billy Park's, put a silver spoon in one's mouth and have one's bird or fish dinner or musty ale without further trouble.

More within the region of practical work, however, is the recent advance in incandescent lighting—an advance not merely in degree but in kind, inasmuch as it is now perfectly practicable to operate incandescent lamps at a distance of 10 or 15 miles from the dynamo machine.

In the past there has been a great gulf fixed between arc lighting, so called, and incandescent lighting, the supporters of high and low tension, respectively, having no dealings with the opposite faction, knowing comparatively little and caring less about the respective merits of the two systems. This gulf is now bridged and high and low tension may shake hands across the "bloody chasm." The merits of the two methods are combined, without the deficiencies of either. The great advantage of high tension is the fact that the current can be conveyed a long distance with a moderate cost for conductors—the advantage of the low tension is its freedom from danger to human life.

In the new system of incandescent lighting from high tension currents, the high tension is used to convey the current along the line to the points at which it is wanted, while, where it is introduced into a dwelling house or store or other place where persons may have access to it, it is of low tension.

Now it is probably not necessary for me to explain to you how the ordinary arc and incandescent circuits are run. In the first, you will remember, the lights are strung along one after another, like birds sitting on a rail; while incandescent lamps are interposed between two main conductors like the rungs of a ladder. In the new system we have a combination of the two—what is known as multiple-series. This arrangement resembles a number of ladders in series, or one following the other—the current passing along the line until it reaches one side of the ladder, then across the rungs of the ladder, or the incandescent lamps, to the other side of the ladder, and then on to the line until it meets another ladder or set of lamps, and so on until the other side of the dynamo machine to that from whence it started is reached. It will thus be seen that the total current generated by the machine, whether 8, 10, 12, or 20 ampères, will pass through these rungs of the ladder, or lamps, which must therefore be of sufficient number and capacity to carry that current. The usual number of 16 c. p. lamps hitherto has been from 7 to 9. For the sake of illustration and simplicity, let us assume a 10 ampère current and 10 lamps in each multiple, each requiring one ampère of current, and say 50 volts of electromotive force. Now, as long as these 10 lamps are perfect, each will carry its due proportion of current, and all will go well. *But*, there is usually a "but" to all things, suppose one of these lamps to break, either from accident or old age, what follows? That lamp, of course, being unable to carry its proper quota of current, the remaining lamps have to carry it, *if* it is not elsewhere provided for, and the means of conveniently and safely providing for it is just what all the endeavors of inventors and others who in the past have attacked this problem, have been directed towards devising. And this brings me to the main point of my subject. Consider what the result of leaving such a multiple unprotected would be. When the first lamp gave out, the remaining ones would still have to carry the same current as the whole of them had previously taken, with the result that those lamps would have to carry more than they could safely stand. Another lamp would soon give way under the strain, and the remaining ones would still have to carry the whole current. Lamp after lamp would go, until the last survivor had collapsed, and then the line would be opened, and the sudden opening of a line carrying some 10 ampères at a pressure of from 1,000 to 3,000 volts generally gives rise to trouble. It is, therefore, from a practical and economical point of view, absolutely necessary that some method of protection should be employed. Now, what is it to be?

Various different devices have been employed. The Thomson-Houston Company have used a "distributing box" which met with a certain amount of success, but has gradually fallen into disuse. It is said that this Thomson-Houston device involves an unnecessary and extensive system of wiring, which is a serious drawback, both in the matter of expense and in the complication of the installation. Mr. Brush has also introduced a multiple-series cut-out, which is certainly extremely simple—in fact too simple, for, in this arrangement, as well as in the case of the Thomson-Houston device, at times a complete extinction of all the incandescent lights is liable to occur—a result which can not be admitted in practice.

There has also been extensively advertised a device known as the "Brown Converter," which depends for its successful operation on the satisfactory working of mercury contacts—mercury contacts for this purpose have long since been abandoned for commercial work, though interesting as a laboratory exhibition.

The principal merit, as before indicated, of the high tension system is the low cost of conductors; the main advantage of the low tension being its flexibility, its safety and its suitability for domestic and store and office illumination.

The nearest approach to perfection in the line of low tension distribution at long distances with which I am acquainted is that recently introduced by a company, which we may really consider a Boston company, The Sun Electric Company of Woburn, Mass.

By means of the system devised by Mr. Slattery, the electrician of that company, incandescent lamps of almost any candle power can be operated from the ordinary arc light circuits which now cover Boston with a net work of wires. This company has shown that the matter has been brought beyond the stage of experiment, inasmuch as the Brush Electric Lighting Company of Boston, alone, have by means of this company's system and apparatus been enabled within the past two or three months to supply considerably over 1,000 incandescent lamps to their customers, and these are to-day in actual and successful operation in this city. Fifteen hundred lamps are in operation in Rochester, N. Y., on the ordinary arc light circuits, several hundred in Portsmouth, N. H., others in New Haven and Bridgeport, Conn., and in many other places, and their number is increasing daily.

The practical working of the system is therefore beyond dispute. It has been said by some one that every new invention has to pass through three stages: First, it is said the thing is impossible to be done; second, "*You* have not done it;" and third, "Oh! it is simple enough, any one could do it, and, in fact, it has been done before." Well, at any rate, this new system has passed the first two stages.

Now, gentlemen, in the sketch which I am endeavoring to give you of this system you must pardon me if I am a little too technical for those of you who are not professional electricians, and perhaps not technical enough for those of you who are. I trust to be able, however, to make myself intelligible, and to give you, at any rate, a general idea of what is done.

To explain the system and circuits fully in a paper like the present would be impossible, and necessitate a number of diagrams; the *results*, however, I can put before you. The mechanical part consists of a "distributing," or, more properly speaking, a "protecting" box, interposed in the arc light circuit just as an arc lamp is, and from which are led the wires supplying the incandescent circuit and lamps or motors. This box contains two or more solenoids or regulating electro-magnets, controlling a series of contacts connected with resistances which are individually switched into circuit on the extinction of a lamp.

The circuits are usually arranged to operate 45 to 50 volt lamps, taking about an ampère of current each, and thus allowing of from one to eighteen lamps, there being when more than nine lamps are in operation at normal incandescence 90 volts in the circuit of incandescent lamps. In the ordinary box the circuit has to be switched over by the consumer from 45 to 90 volts when he requires more lamps than nine. If, however, the circuit be at 45 volts and nine lamps are in circuit, switching a tenth lamp in will do no harm, but the current of the machine being constant, the lamps will not have sufficient current supplied to them, and will consequently become dim, thus indicating to the consumer that he should turn on his 90-volt circuit, to do which he has simply to turn a key or handle projecting from the box, which is kept closed and locked to prevent meddling with it. When the tenth lamp (any lamp in the circuit may be the tenth) is turned out again the box will automatically switch the circuit back to 45 volts, thus saving the energy and cutting out the resistances theretofore protecting that part of the circuit.

The whole of the lamps in the group of incandescents *may* be turned out without injury to the protector or the general circuit, though it would not be economical to do so; when it is desired to turn out all the lights, for the night or otherwise, the box is cut out of the circuit, and the current passes by. When it is wished to use large lamps—*i. e.*, 65 or 70 c. p.—on a box, they are connected to the two outside wires of the three (No. 12) main lines leading from the box, which is then turned to 90 volts.

By a slight alteration of the disposition of the circuit, 8 or 10 c. p. or smaller lamps can also be operated from the box, thus permitting of the conjoint and simultaneous employment of almost any combination of lamps.

The operation of the box when lamps are turned off is simple. The two solenoids or coils on the right and left of the box are so adjusted that when all the lamps are in operation, the spindle in continuation of the armature will rest lightly on the top contact or spring, the circuit of resistance being then open. If, now, a lamp be turned off, or break, more current will be shunted through the solenoid of that side, and the armature be further attracted within the core and cause the top contact to touch the one beneath it, thus closing a circuit through one resistance, taking up the current of the broken lamp, and preserving the balance of the circuit. If another lamp be turned off, the armature will be still more strongly attracted, and depress the first and second strips so as to make contact with the third, thereby switching in a second resistance equivalent to a lamp, and so on, until all the lamps are put out of circuit and all the resistances thrown in.

An arrangement or disposition of circuits and means of protection such as this system offers is new in practice, there having been experienced in all the attempts hitherto made to operate lamps on this principle some difficulty or other which has prevented their commercial adoption and use. It is clear that the time has now arrived when some system of this kind must be adopted for localities not densely populated enough for the simple multiple circuit, and where the arc light is unsuitable. This system will enable miles of arc light wire now unproductive to be made a source of revenue. It will be remembered that in this system the introduction of additional lamps does not mean additional weight of conductors, all that is necessary in such cases being an increase in the E. M. F. of the circuit. The drop of the potential, moreover, is small and constant, as in an arc light circuit.

It has been said that high tension circuits are dangerous. This is only the case where the line is broken by some means and the circuit thereby opened, or in the event of a ground, frequently due to carelessly disposed outside main line. In this system the circuit is never opened, but is always continuous, there never being in any multiple more than the pressure necessary to operate the lamps—usually not over 50 volts, which is of course harmless. On this question of safety the following remarks of Prof. Geo. Forbes are interesting:

"Now a great deal has been talked about the danger of introducing high pressure in electric distribution. I think that I shall find general agreement among competent people when I say that a great deal of what has been talked in this way is pure nonsense, and that high pressures are not in the least more dangerous than our present systems of illumination; that if we have to bring high pressure of electricity through a district, those pressures are confined to the wires, and it is only in the case where there is disgraceful negligence of duty, and a disgraceful leakage toward the earth in some part of the system, that it is possible for anybody to receive a dangerous shock from the wires of such a system. The wires which conduct the electricity into a house of any of these high potential schemes can never have a greater difference of pressure between them than what is required for the lamp; that is, in the present state of affairs, something like 100 volts. We will say that is the highest pressure there can exist between the two wires, and it seems almost incredible that there should ever be allowed to be a leak in the system so great that when a person touches one of the wires he should have a high current flowing through his person which would be dangerous. If we are to abolish the idea of using high potentials simply because of this vague notion that some time a shock might be experienced, we might as well abolish the whole system of gas lighting, because it is possible that people can go into rooms where there is a leakage of gas with a lighted candle. The danger from gas is infinitely greater than that which can ever come from high potential electricity, and the difficulty of detecting a leakage of gas is likewise infinitely greater than the difficulty of detecting a leakage of electricity. A properly organized system of distribution of electricity at high potential would render a severe shock to any person absolutely impossible, and that is the point which needs to be dwelt on very strongly at present, because so much has been talked about the dangers of high potentials." (Cantor Lectures, Society of Arts, Feb. 16, 1885.)

When the connections to the box are made, the circuit is always closed, either through the lamps or the resistances, and to open the line it would be necessary for a person deliberately to set to work to do it.

Another advantage of this system is that in case of an accidental short circuit occurring in the incandescent group there is less liability to injury by fire than in the simple multiple system, as, instead of an enormous current of perhaps 200 or 300 ampères rushing to the spot producing a corresponding effect in heat, there can here only be some 10 ampères or so, according to the current of the machine employed.

In cases where it is desired to provide an "all night" circuit of say two 16 c. p. lamps, this can be done without any waste of energy in the circuit.

Another advantage of this system is that, in cases where it is desired for any reason to modify or vary the intensity of the light of the lamps, by a simple switching device the lights can be toned to any degree required, and unlike other systems, in the event of a reduction of illumination, there is a corresponding reduction in the energy consumed. This is especially applicable to theatrical purposes and has been practically tested in that connection, and is now in actual working operation with the most satisfactory results.

In addition to the ordinary 9 to 18 lamp box with three multiple wires, protecting boxes with a larger number of incandescent multiples, according to the lights required and the exigencies of each particular case, are used.

Now, gentlemen, I am not doing any free advertising for the Sun Electric Company. They do not need it. I simply have presented their system more fully because in my opinion it is the only system which, to use a common expression, "fills the bill." The Brush multiple-series cut-out, I may say, I am pretty familiar with, and, however simple it may be, and however valuable the work it may have done, it still falls short of what developments demand. It errs on the side of too great simplicity; while the Thomson-Houston distributor errs on the side of too great complication. Both these devices are ingenious and meritorious inventions, but the fact of their not having come into any extended use, notwithstanding the demand for something of the kind, tends to indicate their real commercial value.

Now, the system I have imperfectly put before you can, and does, meet all reasonable demands upon it. It is flexible in distribution, economical and safe.

I have only given you an imperfect general idea of what may be done in the development of incandescent lighting in the near future, but if I have laid before you what has been of interest, the object of this paper will have been attained.

Having now touched upon those high tension incandescent systems which call for special notice, I will be told that the same fundamental objection prevails in all alike, namely, the use of equivalent resistances to the lamps and the introduction of those resistances into the circuit as lamps are switched out or burned out, thereby involving a great waste of energy.

Yes! I grant this is a great objection, however much we may try to modify it, and even though we have the advantage of long-distance transmission. But who is bold enough to say how long such a state of things is going to exist? No doubt at all about the fact that the ideal high tension incandescent system is that which will require no resistances, as in the case of low tension incandescent distribution, and that, as in the latter case, lamps will be turned off and on at will without introducing any resistance in the circuit to take the place of the switched out or burned-out lamps. Such a high tension incandescent system, however, has always been considered as belonging to the category of the "philosopher's stone," and as being too good to be true; but how many of those supposed to-be-too-good things have proved true; how many apparently insuperable difficulties have been overcome and unsolvable problems have yielded their tardy solution before persistent and ingenious application. May we not, therefore, reasonably look forward in happy anticipation of the time when the ideal high-tension incandescent system shall be known and used in every town and district throughout the country, dispensing its incalculable benefits wherever civilization finds an entrance, illuminating our homes with the purest and sweetest rays that nature has given to man for man's utility?

* A paper read before the Boston Society of Arts, Nov. 11, 1886.

The Telephone in Russia.—It appears that up to the present time about 10,670 kilometres of telephone lines have been erected in Russia, of which about 4,000 kilometres are in St. Petersburg and about 3,000 in Moscow. The number of instruments in use is not stated.

The "House" Telephone.—The *Scientific American* comes to the rescue of the telephone speculators. It asserts that Royal E. House obtained in 1865 and 1868 patents which clearly anticipated Professor Bell's devices. It publishes a leading article announcing that the Bell patent is probably broken and gives prominence to several illustrations of the House instruments. Notwithstanding the high authority of the *Scientific American*, the statement that a new and probably successful claimant for the profits of the Bell invention has arisen will be accepted with great reserve. If patent lawyers had considered that the letters patent issued to Mr. House protected his rights in the speaking telephone as one of the possibilities of his own invention there would probably have been long ago another case on the calendar of the United States Supreme Court. Possibly the House patents will be caught up by the baffled Government lawyers very much as straws are snatched by drowning men.—*New York Tribune.*

The House "Electro-Phonetic Telegraph."

Considerable interest is fe't at the present time in telephonic circles in the invention of Royal E. House, covered by letters patent No. 77,882 of 1868, and described by him at that time as an improvement in electro-phonetic telegraphs. Special attention has been called to the subject because the invention is put forward as an anticipation, practical and operative, of the Bell telephone, and because a company in this city, said to be influentially supported, is now manufacturing the instruments and putting them on the market as telephones for ordinary service, the apparatus being, it is claimed, the same as that shown in the patent except that "to adopt it to modern use some minor changes

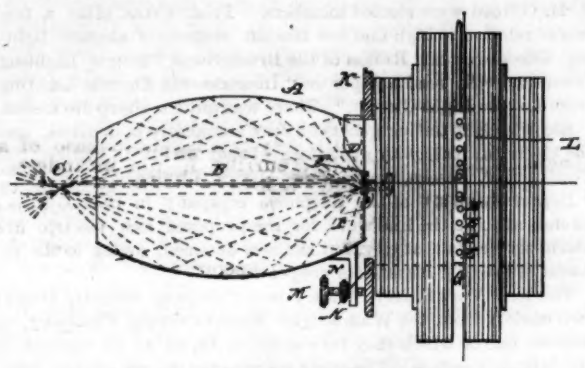


FIG. 1.—THE HOUSE TELEPHONE.

in proportions and material have been introduced." The talking of this "telephone"—in its present shape—is said to be remarkably good.

In view of the importance attaching to the subject, we reproduce in *fac simile* the six drawings that accompanied the original patent of 1868, and quote the inventor's own language, so that our readers may form opinions of their own as to the possibility of any disturbance of existing conditions in the telephone field by this revival of an invention more than eighteen years old. Fig. 1 is a side elevation of the sounder and helix, with accessories; Fig. 2 is a horizontal and longitudinal section through a helix and sounder; Fig. 3 is a section through a helix, showing a set of deflective needles, and an interior view of the helix which is nearest the needles in the direction of the sounder; Fig. 4 is an end elevation of a sounder; Fig. 5 is a side elevation of an electro-magnet sounder and accessories; and Fig. 6 is a diagram intended to show the method of ascertaining by the action of light the inside curve of the reflector for any given length and diameter. We will now let the inventor, in his own phraseology, tell what are the uses of the parts spoken of:

The feature of my present invention may be divided into three heads, and are:

First, a sounder, so constructed and arranged as to regulate the loudness of the sounds, and to intensify them, by a single reflection, to a point most convenient to the operator's ear, by which means greater distinctness of sound is secured.

Second, a deflective-needle helix, constructed and arranged with reference to bringing a greater length of insulated wire, in closer proximity to the permanent deflective magnetic force, to be deflected by the passage of an electric current through the insulated wire of the helix, than heretofore practiced.

Third, increasing the permanent deflective magnetic force which is to be deflected in proportion to the increased inertia of the material employed for that purpose, which enables me to augment the force, so as to produce sufficiently rapid and heavy blows by moving through exceedingly short distances, which removes the difficulty of bounding.

I shall now proceed to describe the sounder and its accessories.

The sounder *A*, Figs. 1, 2, 4 and 5, is composed of a reflector *B*, somewhat barrel-shaped, and closed at the end opposite the intensified point *C*, as shown in Figs. 1, 2 and 5, by the insertion of sounding-head *D*, which has adjustable limiters *F F* or F^1 F^2 attached, for the purpose of limiting the motion of an armature *H*. Fig. 5, of an electro-magnet *I*, or the motion of a set of deflective needles, fixed in shaft *G*, Figs. 1, 2 and 3.

In the construction of reflectors that intensify the sound

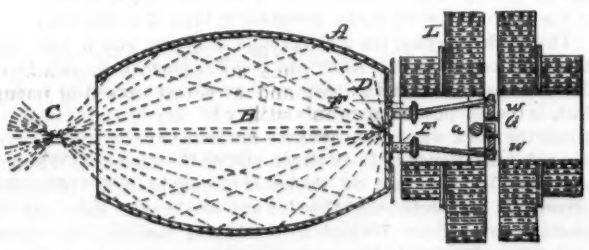


FIG. 2.

by a single reflection, as practiced in the present invention, it becomes a matter of importance to have some easy mode for determining the exact curve of the inside of a reflector of any given length and required diameter. Knowing that the laws of sound correspond with those of light, the particular form of the curve of the sides of the reflector for any given length may be ascertained by the reflection of light.

I generally use a desirable number of small mirrors, arranged as shown in Fig. 6, in which the eye is placed at the intensified point *C*, and a candle *J*, or some other suitable object, is placed at a point equidistant from each limiter *F F*, on sounding-head *D*, and reflected, by a single reflection, to the intensified point *C*, by mirrors 1, 2, 3, 4, 5, 6, 7, 8, 9, placed at suitable angles, thus fixing the position of each point of a curve, so as to be averaged, and give the shape to a pattern extending the entire length, and embracing one-half the diameter of the reflector *B*.

I now proceed to make the reflector of tin or any suitable material, being careful to have the inside shaped to correspond with the pattern.

The sounding-head *D* may be made of wood or glass, or any suitable material. I prefer pine wood. One made one-quarter of an inch thick, and eight inches in diameter, stiffened by being well saturated with shellac varnish, and fixed in its respective end of the reflector, answers a good purpose, providing the size of the pattern of the reflector is made with reference to that diameter.

The limiters *F F*, Figs. 1, 2 and 3, should be made stiff and light of suitable sized thin brass tubing, and fixed, in an adjustable manner, to sounding-head *D*, and closed at the ends, which are to receive the blows from the set of deflective needles fixed in shaft *G*.

The sounder *A* is suspended in a proper position, by being suitably hinged to the case which holds the helix *L*. Two detached sections of the case *K K* are represented in Fig. 1. The opposite side of the sounder is adjusted by thumb-screw *M*, which rests against the case *K*, and screws through the projecting arm *N*, Fig. 1, which is fixed on the lower side.

The withdrawal or moving up of limiters *F F*, represented in Figs. 1, 2, and 3, is accomplished by screwing up or unscrewing the adjusting screw *M*.

I have sometimes used a cam against the end of screw *M*, arranged so that moving the cam backward or forward produced the same effect as moving the screw.

I have now described the sounder, and the mode of using it in combination with deflective needles, and will now give another mode of using it, in combination with a receiving electro-magnet of a telegraph line without a local circuit.

I have found, by experiments, that when the force of an armature of a receiving-magnet is expended on limiters F^1 F^2, by limiting the motion of the armature, a distinct audible sound is produced, even when the electrical power is only sufficient to produce motion.

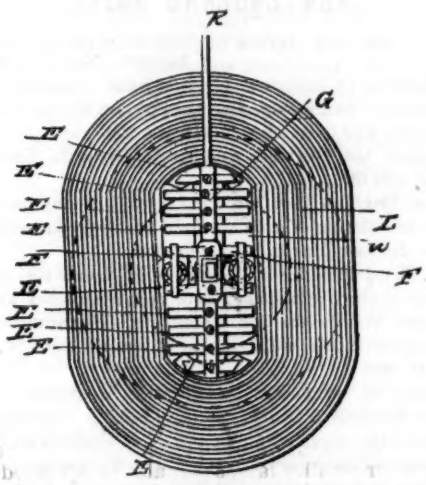


FIG. 3.

I have combined a very good arrangement, which is represented in Fig. 5, in which one limiter is struck on the end and the other on the side, which, for distinctness of sound, answers an excellent purpose. The method of striking one limiter on the side and the other on the end, to produce distinctness of sound, is not new, but has been long in use in local circuits where the magnetic force was sufficient without the employment of an intensifying sounder.

Fig. 5 represents the combination of the old arrangement with reflector *B* and sounding-head *D*, which may

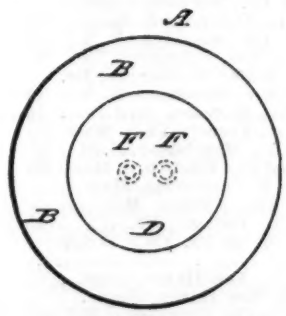


FIG. 4.

be placed in a stationary manner on the frame which holds the temporary electro magnet *I*. Fig. 5, which has an armature *H*, with an adjustable reacting spring *O*, and a fixed arm *P*, projecting from the armature at right angles, and working on an axis at *Q*, so that when the magnet *I* is charged with magnetism, the armature *H* brings the fixed arm *P* in contact with the end of limiter F^1, and when discharged, the reacting spring pulls the end of armature *H* against the side of limiter F^2.

I shall now proceed to describe the second and third parts of the feature of my invention.

In the construction of a permanent deflective magnetic force, Figs. 1, 2, and 3, designated by the letter *E*, I select the best material of cast steel, of suitable size and length for permanently holding an amount of magnetism which shall be the largest in proportion to the weight of steel employed for that purpose. I then multiply the number of such pieces to any extent desirable, or, at least, until suitable weight is attained to make audible sounds, by arresting their motion against the ends of limiters *F F*, Figs. 1, 2, and 3, after being deflected through an exceedingly short distance, say, one-hundredth of an inch. They are then arranged with similar poles side by side, and at such distances apart as will allow each deflective needle to retain its full force of magnetism, in which relative position they are fixed to the oscillating-shaft *G*, Figs. 1, 2 and 3, which has a suitable-sized aperture, provided with a set-screw for each needle, designated by the letter *E*.

The necessary distance between each consecutive needle may be ascertained by measurements made by the deflection of an ordinary compass-needle, placed at a proper distance and in a suitable position from the north or south poles of two or more magnetized needles, arranged parallel with each other, and their similar poles side by side, in a movable manner, so as to increase or diminish the distance between them as desired, the experimenter being careful to note the degrees of deflection of the compass-needle which exists at the several distances through which they are moved, and then selecting for use the distance between the magnetized needles when a maximum charge of permanent magnetism was shown by the compass-needle to exist.

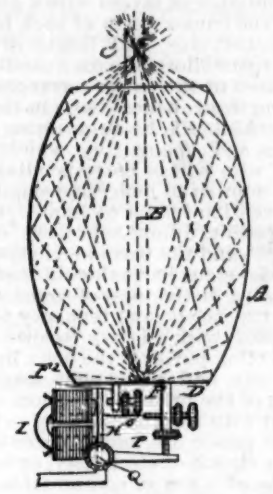


FIG. 5.

The number of deflective needles which compose a set may be increased according to the length and insulation of the telegraph line in which they are used. When combined with a line of ordinary length and construction, the number shown in the drawings would answer a good purpose, but if used in connection with a very long submarine telegraph line, in which extreme sensitiveness becomes important, the number of deflective needles should be correspondingly increased.

The oscillating needle shaft *G*, Figs. 1, 2 and 3, may be held in any frictionless manner that will allow it to oscillate freely without trembling. I have used it with much success with the needle-shaft in a vertical position, suspended by a suitable torsion suspensory apparatus, which acts as a reacting power, and which may be regulated by torsion to meet the exigencies of a waste current of a telegraph line.

The connection of the torsion suspensory apparatus is made by connecting its lower end to the upper end of wire *R*. Figs. 1 and 3, which is fixed in the upper end of the oscillating-needle shaft *G*. This arrangement requires the use of a frictionless device, to secure the centre of motion of the deflecting needles at a fixed point in the centre of the axial aperture of the deflective-needle helix *L*, Figs. 1, 2 and 3, and I have selected for this purpose a knife-edge *S*, Figs. 2 and 3, fixed in an opening *T*, of the oscillating-needle shaft *G*, in a suitable manner to secure the axis of motion, by lightly bearing against the bottom of a suitable shaped cavity formed in arm *U*, which may be fixed to the helix *L* in any suitable manner.

The force to keep the knife-edge resting against the bottom of the cavity *V* may be increased by carrying the point of suspension of the suspensory apparatus out of a vertical line, in an opposite direction from the limiters, or diminished by moving it back toward them. It is important that the force be so regulated as to produce the desired effect without diminishing the sensitiveness with which the knife-edge acts in its bearing.

I will now explain the mode of obviating the difficulty in the arrangement previously patented, in which the deflective needle had a tendency to slightly stick to the limiters, which limited its motion, by coming in contact with its magnetized parts, so as to diminish its sensitiveness when operated on a telegraph line having a heavy escape-current. This difficulty is removed in my present invention by arranging the limiters *F F*, Figs. 1, 2 and 3, so as to be struck with device *W*, made of demagnetic metal, and fixed to each end of the two deflective needles nearest the centre of the set in shaft *G*.

The deflective-needle helix *L*, used in combination with the set of deflective needles, is constructed with an axial

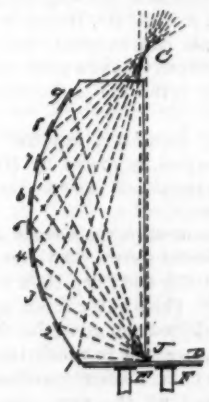


FIG. 6.

aperture, the shape and size of which is made with reference to the length, size, and number of deflected needles, arranged in a row parallel with each other, and with each consecutive needle separated from the other at such distances apart as to allow each needle to retain its full amount of deflective magnetic force. A good idea of this part of the invention may be gained by examining Fig. 3, in which is represented half of the deflective-needle helix, showing an axial aperture constructed and relatively arranged and combined with a set of deflective needles, in accordance with the principles of this part of my invention.

The axial aperture in deflective-needle helices heretofore constructed for telegraphic purposes has had an oblong shape, with a deflecting needle placed in the centre, with its poles in a parallel position with the sides of the oblong, and at right angles to the axis of the helices.

The amount of helical wire of a given size used in constructing such helices has been regulated by the length and size of a single or compound deflective needle, and the number of layers of helical wire having a given number of convolutions.

In the present invention, the poles and intervening spaces of the set of deflective needles are relatively arranged at right angles to the sides of the oblong aperture, and at right angles to the axis of the helix, as shown in Fig. 3.

The amount of helical wire of a given size, used in forming a fixed number of layers with a given number of convolutions, in the construction of such helices, is regulated by the number, size, and length of the deflective needles, and the space allotted to each needle, respectively.

The principle used in the latter arrangement admits of increasing the length of helical wire in the construction of a deflective-needle helix, by augmenting the number of deflective needles and spaces, by which the increased length of helical wire will be correspondingly acted upon by the increased number of deflective magnetic needles.

The present invention relates to improvements in a previously-granted patent, numbered 48,408, on the electrophonetic telegraph, and the parts herein specified are to be substituted for analogous parts therein described, for the purpose of increasing distinctness of sound, and remedying the bounding of the needle and tendency to stick to the limiters, when used with a heavy escape-current, and to increase the deflecting power of the helix by increasing the length of helical wire and permanent magnetic force, or some of the parts of the present invention, or all of them, may be combined with suitable parts of a magnetic-telegraph line now in public use, and operated either by breaking or closing the circuit of electricity, or by changing the current by the use of a key or commutator.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Nov. 15, 1886.

Mr. Clark B. Hotchkiss reports business as very good. The Kerite factory is kept in full swing of activity. He has made all the cables for the Pacific Postal Telegraph Company, from San Francisco to the Canadian Pacific. There are from 3 to 4 miles of submarine cable made with 7 conductors of three No. 18s stranded together, and armored with 18 No. 4 iron wire. The cable weighs 20,000 lbs. to the mile. While filling these orders for work away off on the Pacific coast, the concern has been no less busy at home. One of its cables, of peculiar construction, has recently been put across the Brooklyn Bridge, and in fact, New York is literally begirdled with Kerite cables in service for the Western Union, Baltimore & Ohio, United Lines, Metropolitan telephone, long-distance telephone and other corporations. Not only do they run overhead in all directions, but they lie at the bottom of the North River in sufficient number to lasso the biggest steamer afloat there.

President Goff, of the American Electric Manufacturing Company, gave a dinner, on Friday evening of last week, to a few friends in one of the cosey private dining rooms of the Hoffman House. Among those present were U. S. Commissioner Osborn, Senator Kiernan, L. M. Bates, Vice-President of Mr. Goff's Company; A. S. Hatch, the banker; Henry F. Gillig, President American Exchange in Europe; Col. F. K. Hain, of the Elevated Railway: Col. F. A. Burr, of the New York *World;* W. J. Johnston, of THE ELECTRICAL WORLD; E. W. Burdett, H. C. Adams, William G. Bates, H. E. Irvine, Nat. Ross, Thomas Grimwood, W. S. MacFarlane, John R. Abney, E. H. Hastings and Wm. F. Scott. It was a very enjoyable affair, the toasts being responded to in that good-natured, informal way that makes every one feel perfectly at ease, and creates a spontaneous desire on the part of each guest to do all he can to add to the pleasure of the rest. Several of the speakers took advantage of the occasion to congratulate Mr. Goff upon the wonderful strides made by the American Company's system of electric lighting since the removal of the executive office to New York.

I seized last week the opportunity to take another glance at the American Institute Fair, which, like other institutions of the kind, will be in its best shape about the time it is closed. I have already noted many of the exhibits, and may now give a word or two to some others. A special compliment is due to the woman photographer who, with commendable enterprise, is taking photographs every night with the aid of the Ball electric light. The "C. & C." motor is doing duty with credit, running a heavy sewing machine. A very neat printing telegraph system is shown by M. W. Grovesteen & Co. Mr. Henry Seligman's mechanical and magneto telephones can be tried, and the Holmes Burglar Alarm Telegraph Company have a good exhibit of their system, including an antiquity in this line in the form of a burglar alarm dating back to 1860.

The Kellam damper regulator, familiar to a great many of your electric light readers, is shown by Hine & Robertson, sole agents, 12 Cortlandt street. It is controlling the two boilers used in running the engines.

In their own line, as of yore, the Jerome Kidder Manufacturing Company make a splendid show. The company won the Institute's gold medal in 1875, and from 1872 to 1884 carried off also the "highest award." The display is not as large as might be made, but it is well selected and gives the thousands who visit the fair a good idea of the manner in which the Kidder apparatus is now so largely used by the medical profession to cure every one of the old diseases and all the new ones. The exhibit merits special praise for the beauty of workmanship displayed by all the company's products in it.

A new kind of alarm is that of the Vassar Burglar Alarm Company, with offices in the "Domestic" building. It is intended to guard bolts, is proof against the "jimmy," and always sends the disappointed thief away to reason with his conscience. This alarm is made with mechanical or electrical equipment, and besides being adapted to household use, is finding a favorable reception with safe and safe deposit companies.

The dynamo of Mr. E. P. Clark you have already noticed and described. It attracts the attention of a good many visitors, and from all the tests made appears to be a machine of unusually high efficiency. I saw it running very nicely 7 seven-year-old Fuller lamps. Mr. Clark is a young man of great ingenuity and perseverance, and will not stop short with what he has already achieved.

The New York Electric Brush and Ozone Company show Prof. Culps' electric flesh brush and his ozonizer. There can be no question as to the fact that these appliances give forth electricity. The brush yields a half-inch air spark, and in the case of the ozonizer, the electricity can be both heard and felt. The company show also their electric gas-lighter.

The Galvano-Faradic Company have a full line of their goods on view. They make a special display, with judgment, of apparatus for family use, and call attention to their family instrument. It is surprising how many people are still nervous and apprehensive about the most simple, yet beneficial, electrical treatment. This instrument will go far to cure them at once of their pains and their fears.

E. P. Gleason & Co., the well-known globe and shade manufacturers of Mercer street, have a remarkably fine display of electric light goods. It is wonderful how much beauty and taste they have managed to concentrate on small globes and shades, and how skillfully the most varying needs have been studied and met. It is about time that advantage was fully taken of the æsthetic superiority of the electric light in giving it such accessories as these.

One of the engines on exhibition this year is the Wheelock, made by Wheelock's Steam Engine Works, Worcester, Mass. It is running the Ball machine giving 20 arc lights, as well as other machinery, and in connection with it is used the well-known Underwood cotton belting. Another engine shown in operation is the Twiss, made by Nelson W. Twiss, of New Haven, Conn. It is running 25 Ball lights. The Otto people also show, through Mr. A. C. Manning, of 47 Dey street, one of their popular silent gas engines, and the Williams & Orton Manufacturing Company, of Sterling, Ill., show the Charter gas engine, which they guarantee for arc lighting.

I think enough has been said for the present to show that electricity and its adjuncts are not altogether wanting at the fifty-fifth Institute Fair. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Nov. 15, 1886.

The following Connecticut electric light companies have filed certificates of organization, viz., the Putnam Electric Light Company, capital $12,000; the Torrington Electric Light Company, $12,000, and the Norwalk and South Norwalk Electric Light Company, $50,000.

The New England Ball Electric Light Company has just completed an installation of a 25 arc-light plant in the establishment of Messrs. Jordan, Marsh & Co., Boston.

Messrs. Sowdon, Elder & Wright, N. E. agents for the American system of electric lighting, have just completed an installation for the Westbrook Manufacturing Company, Saccarappa, Maine, and one at the establishment of Messrs. Seth W. Fuller & Holtzer, Boston.

A number of prominent and wealthy gentlemen residing in Saco and Biddeford, Maine, recently held a meeting, and took steps toward the organization of a stock company under the name of the Saco and Biddeford Electric Light Company.

An electric light company has been organized at Northampton, Mass., for the purpose of purchasing the Thomson-Houston plant in that town, and a capital stock of $40,000 has already been subscribed. The following officers were chosen: E. P. Copeland, C. H. Pierce, A. G. Hill, clerk, and E. A. Brooks, auditor.

The Thomson-Houston Electric company reports a steady demand for its arc and incandescent systems at home and abroad. As substantial proof of the enormous business done each month by this company, the following is an authentic list of new plants installed and increase in lights made during months of September and October:

	Arc.	Incan.	
Standard Lt. & Pr. Co., Montpelier, Vt..	60	300	New
Salem Elec. Lt. Co., Salem, Mass.....	120	100	Increase
Norwich Elec. Lt. Co., Norwich, Conn...	..	150	"
Middlesex Elec. Lt. Co., Lowell, Mass...	20	....	"
Citizens Elec. Ill. Co., Brooklyn, N. Y..	45	....	"
Carnegie, Phipps & Co., Pittsburgh, Pa..	60	....	New
Bangor Elec. Lt. & Pr. Co., Bangor, Me. ..		300	"
Municipal El. Lt. Co., Brooklyn, N. Y..	45	....	Increase
Hudson El. Lt. Co., Hoboken, N. J.....	45	....	"
Citizens El. Lt. Co., Turners' Falls, Mass.	30	....	New
Amoskeag Mfg. Co., Manchester, N. H..	45	....	"
Fitchburg Worsted Co., Fitchburg, Mass.	30	....	Increase
Day Cordage Co., E. Cambridge, Mass...	..	50	New
Asa Cushman & Co., Auburn, Me.....	..	600	"
Rutland El. Lt. Co., Rutland, Vt.....	45	....	Increase
Woonsocket El. M. & Pr. Co., Woonsocket, R. I.....	..	300	New
New Haven El. Co., New Haven, Conn...	75	600	Increase
Sperry & Barness, New Haven, Conn....	..	200	New
Narragansett El. Lt. Co., Providence, R.I.	40	....	Increase
Auburn Woolen Co., Auburn, N. Y.....	38	....	"
Elec. Lt. Co., Naugatuck, Conn.....	30	....	New
Nashua El. Lt. Co., Nashua, N. H.....	45	250	"
Malone El. Lt. Co., Malone, N. Y.....	45	150	"
Moody, Estabrook & Anderson, Nashua, N. H.....	..	300	"
Springfield Elect. Light Co., Springfield, Mass....	45	....	Increase
Fall River El. Lt. Co., Fall River, Mass..	50	....	"
Hudson El. Lt. Co., Hudson, Mass.....	45	....	New
Heywood Bros., Gardner, Mass.....	..	400	"
Brown, Howard & Co., Tarrytown, N. Y.....	30	....	"
Pawtucket El. Lt. Co., Pawtucket, R. I..	50	400	Increase
Ferman Manufacturing Co., North Adams, Mass.....	9	....	New
Worcester El. Lt. Co., Worcester, Mass..	90	....	Increase
Clyde steamers, New York.....	..	100	New
Bristol El. Lt. Co., Bristol, Conn.....	..	75	Increase
Elec. Lt. Co., Mobile, Ala.....	45	....	"
La Fayette Gas Light Co., La Fayette, Ind.....	45	....	"
Terre Haute Elec. Lt. and Pr. Co., Terre Haute, Ind.....	..	300	"
Adrian El. Lt. Co., Adrian, Mich.	45	....	"
Selma Gas Co., Selma, Ala.....	30	....	"
Town of Danville, Virginia.....	30	....	"
Atchison El. Lt. Co., Atchison, Kan.....	100	....	"
Cleveland El. Lt. Co., Cleveland, O... ..	45	600	"
Hill City El. Lt. Co., Vicksburg, Miss...	30	....	"
Memphis T.-H. Elec. Lt. Co., Memphis, Tenn.....	30	....	"
T.-H. El. Lt. Co., Detroit, Mich.....	45	....	"
Oakland Gas Light and Heating Co., Oakland, Cal.....	25	....	"
Badger Elec. Co., Milwaukee, Wis.....	100	....	New
Columbus Elec. Lt. and Pr. Co., Columbus, O.....	30	....	Increase
Mahoning El. Lt. Co., Youngstown, O...	30	....	"

Work upon the station of the Newton Electric Light and Power Company, on Crafts street, Newtonville, Mass., is being rapidly pushed forward. The building is to be two stories, 30x80, with a boiler house, 36x40, to be built of brick. The engine and dynamo room will be arranged for six direct-acting Armington & Sims engines, belting direct to 12 dynamos. The company has recently added to its board of directors Mr. J. N. Keller, general manager of the New England Telephone Company, and Mr. H. H. Cutter, former superintendent of the Thomson-Houston Company at Akron, O. The company will commence business by January, and will place lights in the squares at Newton, Newtonville and West Newton.

The regular meeting of the Society of Arts was held on Thursday evening, November 11, at the Massachusetts Institute of Technology, Prof. Charles R. Cross, president, in the absence of President Walker. Messrs. D. P. Bartlett, Frank Ridlon and H. E. H. Gifford were elected members. Prof. Cross, after a few words relative to high and low tension systems of electric lighting, introduced Mr. Ridlon of the Brush-Swan Electric Lighting Company, who read a paper on "Incandescent Electric Lighting from an Arc Light Circuit." There was quite a sharp discussion.

Electric light testing generators are frequently in demand, and the electrical fraternity are informed that Albert L. Russell, 109 Court street, Boston, makes a specialty of this line of goods.

Reports have it that the telephone company in Salem, Mass., promised to do the line work for the proposed new electric fire alarm service in that city, but has now declined, owing to the demand of the city council for copper wire.

The New York Safety Steam Power Company recently bought two beaters from the Wainwright Manufacturing Company, of Boston, one of which they forwarded to Japan to be erected in the Mikado's palace. The other was erected at an electric lighting plant in Albany, and gives satisfaction in heating the feed water to high temperature, with but little of the exhaust being employed. It also is very efficient as a muffler of the noise of exhausting steam.

The Underwood Belting Company, at Tolland, Conn., is adding a large amount of new machinery to its already extensive manufacturing facilities.

The Wheeler Reflector Company, of Boston, has recently filled a large order for its handsome shades and reflectors for incandescent lights, from the Greeley Electric Light Company, Greeley, Colorado, and has fitted up the entire Mather plant in the Atwood Machine Company's factory, Stonington, Conn., with the same specialty.

The Revere Rubber Company are putting up a brick addition to their works at Chelsea, Mass, on account of the growth in several departments. Their specialties are belting, packing and hose, though they make all kinds of rubber goods for mechanical purposes.

Mr. Josiah Quincy, manager of the Chemical Electric Light & Power Company, gives out the following report relative to the operations of his company: "The Pennsylvania Chemical Electric Light and Power Company have been organized at Chester, Pa., with a capital of $50,000, and are licensees under all the 'Volta-Pavia' patents for the State of Pennsylvania. Dr. E. A. Hutchins, of Wichita, Kan., has just contracted with the Chemical Electric Light and Power Company for that territory, covering the States of Kentucky and Kansas." W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Nov. 14, 1886.

Electricity as a motive power for street cars seems to be attracting greater attention than ever in this city. The "Traction Company," which runs its cars by means of an underground revolving cable, is now looking out for even cheaper and more convenient motive power. Several new and untried systems have been examined by the Traction engineers recently, and the Julien has made such a favorable impression that it is to be tried here in a short time.

On Wednesday last, the electric railway on Ridge Avenue, which had ceased to run cars, having for three months demonstrated the feasibility of the plan, was operated again for the benefit of a number of gentlemen who desired to examine into the working of the motor. William J. Richardson, secretary and treasurer of the American Steel Railway Association and president of the Street Railway Association of New York State; N. H. Frost, treasurer of the Atlantic Avenue Railway of Brooklyn; Hon. John P. Veree, Select Councilman Joseph B. Van Dusen and others, rode in the car over the route and received an exhaustive explanation of the methods and uses of electricity as a railway motive power. All the gentlemen expressed themselves well satisfied with the results of the inspection. This road is, I think, the only one of the kind ever constructed in America, as it has an underground conduit to carry the conducting wires.

Underground work is also going along briskly in this city.

The work of laying the underground conduits, which will contain the cables of the American Bell Telephone Company from Delaware avenue and Ton alley, which was commenced on Friday last, is being pushed forward night and day by the Company. Since the work was commenced the conduits have been laid from the point mentioned to Dock street, and on Dock street to Walnut, and will be continued on the latter thoroughfare to Thirteenth street. It is expected that this line and two branch lines, one on Second street from Walnut to Arch, and the other on Fourth street from Walnut to Vine streets, will be completed and in successful operation before the 1st of December. The conduits are laid two feet beneath the street surface.

PENNSYLVANIA NOTES.

READING, Pa., Nov. 10, 1886.

The Reading Electric Light Company have moved into their handsome new building and settled down to business at last. The company were, previous to this year, solely engaged in the arc light business (Arnoux-Hochhausen system). Their business has grown so far beyond their most sanguine expectations that they were compelled to look for new quarters. The demand for an incandescent plant was such as to compel the company to investigate the various systems in the market, with a view to lighting the city. After due consideration, they selected the Edison system,

and closed a contract for a 4,000 light plant with Mr. J. S. Humbird, State Agent for the Edison Company. The company reorganized and increased its capital from $75,000 to $150,000. Ground was broken for the new station in February, but building and equipping was not completed until August. The main building is a three-story structure, 41 × 115 feet, with an annex 60 × 40 for boiler-room.

The first floor is entirely used as dynamo and engine room. The second and third floors are to be rented out with power for manufacturing purposes. The plant was designed and built by the Marr Construction Company, which has had an extremely wide and varied experience in the construction of electric light plants.

The workmanlike manner in which all the work is done redounds great credit on Mr. H. M. Doubleday, the Marr Company's superintendent, as do all the plants which he has designed. The electrical work in the station is unusually fine, and reflects great credit on Mr. Thomas Spencer, chief electrician for the Marr Company. The ingenuity displayed by Mr. Spencer in the location of electrical apparatus for the convenient manipulation of the system is typical of the thoroughbred New Englander.

The system was started up with about 2,000 lamps of 10 c. p., and there is every indication of the present electrical capacity being taxed to its utmost ere the new year. The steam plant is an interesting feature. The company have installed four 150 h. p. Ide automatic cut-off high-speed engines. The striking merits of this engine are accuracy of regulation and thorough mechanical construction. There are five boilers with a capacity of 600 h. p., with Jarvis setting, put in under the personal supervision of Mr. J. C. Coe, of Boston. The plant is complete in every detail, and the Reading Electric Light Company have every reason to congratulate themselves that their plant is second to none. The company have in contemplation the installation, at an early date, of a number of Sprague motors, to be used generally over their system.

D. C. S.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Nov. 13, 1886.

The most welcome news of the week, to holders of telephone stock, came from Ohio in the shape of an announcement that the government had received its first set-back in its suit against the American Bell Telephone Company. Report says that nothing further will be done until the government attorneys have a consultation in December. In fact, it is thought by some that the whole matter will now be dropped, though this hardly seems probable. The government has made so much preparation and fuss that it would seem to be bound to go on with the matter. This set-back is, in all likelihood, the first of a long series of similar discouragements, which may lead, after all, to the government's defeat and discomfiture.

The Fort Wayne Jenney Company has secured the contract for a 30-lamp electric light outfit for Warsaw, N. Y.

And now Albany, N. Y., is to have the multiple switch-board. Next?

The Railway Telegraph Supply Company has secured the Western Union repair contract, covering nearly 1,000 instruments.

Edward E. Harbert & Company, of Chicago, are furnishing the apparatus for a mechanical telephone exchange at Murray, Idaho, of 25 lines.

The Shultz Belting Company of St. Louis, report trade good. They lately received a cable order for belting from Belgium.

The Sperry Company, which lighted the Exposition here so creditably, are now lighting the Fat Stock Show with four dynamos and eighty lamps. The lamps are suspended from the dome and all around under the galleries. Power is furnished by a Crane-Corliss engine. The Sperry Company are just finishing up installations of arc plants at Coffeeville and Independence, Kan., and an incandescent plant for Johnson's Chair Company, Chicago. They are just commencing work on an arc light plant at Fruitport, Mich., and are wiring the Leland Hotel, Chicago, for incandescents. They are also engaged in putting in an arc plant for Arnold Bros., Chicago.

Col. S. G. Lynch, broker, of 146 La Salle street, Chicago, furnishes the following telephone stock quotations:

Bell of Mo.	$150@$152
Central Union	45@ 47
Chicago	375@ 400
Colorado	20@ 22
Cumberland	75@ 80
Great Southern	25@ 27
Iowa Union	16@ 19
Michigan	69@ 70
Rocky Mountain Bell	40@ 45
United	17@ 19
Wisconsin	104@ 106

W. A. K.

DETROIT, Nov. 10, 1886.

The new Edison plant here has gone into operation. An idea of the work may be based on the following from the Detroit *Free Press* of Nov. 9, which says:

At 5:30 o'clock last evening the current from the Edison electric light station, at the corner of Washington avenue and State street, was turned on for the first time for practical use, and, instantly, 2,000 lights were actually aglow or only lacked the hand of some one upon the thumb screw to be so. From that time throughout the evening and night the engines worked steadily in supplying power to the patrons of the company, and not a single complaint as to failure of service was received—truly a wonderful record for the first hours of so great an enterprise. A reporter for the *Free Press* called at the station last evening and was piloted through by J. H. Vail, General Superintendent and Chief Engineer of the parent company.

To begin at the foundation, the station is now equipped with two Zell water-tube safety boilers, equipped with the Murphy stoker, a Detroit invention, which insures very perfect combustion. These develop 1,200 horse-power and drive four Armington & Sims engines. These engines each supply the power to two dynamos and each dynamo has a capacity of 500 lamps of sixteen candle-power each. Thus the present capacity of the power station is 4,000 lamps, or double the number in actual operation.

This is, however, little more than a beginning. There is space in the engine-room for twenty engines, or five times the number now in use; to propel this gradual mechanical increase two more boilers of capacity equal to those described may be added on the same floor; to this it is contemplated to add another floor, giving a total of eight boilers, with 4,800 horse-power capacity, and in this, as in all respects, further additions will be made as they are needed.

The Edison wires are laid exclusively under ground. Said Mr. Vail last evening, "We are far more anxious to go underground than any one is to have us. This system enables the company to accomplish one great improvement upon any previous device. It has two systems of wires, running side by side, known as mains and feeders. The former deliver the current directly to the consumer; the latter intersect the mains at various points and convey the power from the station."

The advantage of this is illustrated by Mr. Vail's answer to a question. Stepping to a map of the Edison system hanging upon the wall, the reporter indicated a point at the intersection of Park street and Woodward avenue, and asked: "What would you do if your connection should break between the station and that point?"

In answer Mr. Vail indicated five different connections by which the current could be conducted to the same point, thus positively insuring against interruption.

As the reporter was about to go Mr. Vail said: "The next thing you know we will be furnishing the power for *The Free Press* machinery. We have now a power station in Boston which distributes sixty-five horse-power to small consumers for sewing-machines, etc. This power-supplying system will be greatly expanded in scope. We have now sixty-five central stations in various cities, capitalized for $7,000,000. The Detroit company has a capital of $700,000."

THE TELEGRAPH.

Parsons, Kas.—The Kansas City and Pacific Telegraph Company, of Parsons, Kas., incorporated by E. H. Edwards and others, has a capital stock of $500,000.

The International Railway Telegraph Company, of New York City, has been incorporated by Thomas A. Edison and others with a capital stock of $250,000.

A Good Idea.—The A. N. Kellogg Newspaper Company, advertising agents, have their letter sheets and envelopes printed in the style of those used by telegraph companies. The postage stamp is put on the back of the envelope. The imitation is very ingenious and effective.

Pacific Postal.—The stockholders of the Pacific Postal Telegraph Cable Company have elected the following directors for the ensuing year: John W. Mackay, President; W. C. Van Horne, Vice-President of the Canadian Pacific Railway Company, Vice-President; E. C. Platt, Treasurer; J. O. Stevens, Secretary; Sir George Stephen, President of the Canadian Pacific Railway Company; C. R. Hosmer, A. R. Chandler, H. Rosener, H. De Castro, and J. O. Stevens.

Suppressing the Bucket Shops.—A new plan to suppress bucket shops and restore speculative trading to former channels is being agitated by a number of members of the Chicago Board of Trade. The idea is to abolish the market reporting department of the Board of Trade, at least temporarily. Without official quotations received over tickers, it is claimed, bucket shops cannot secure enough patronage to pay office expenses. The claim is also made that by cutting off all official quotations the outside agent who sends his orders to the large city bucket shops will be obliged to reconnect himself with regular brokers. A petition asking the Directors of the Board of Trade to submit for ballot a proposition repealing the rules providing for the maintenance of a marker department was signed by over 75 members in a very short time last week. There was no attempt to make a canvass of the board. The petition has now been referred by the Directors to the Committee on Market Quotations. By the proposed plan the ticket service would be dispensed with altogether in grain and provision speculation and the present system of market reports from the city discontinued.

THE TELEPHONE.

A Jump.—Upon the announcement of the Cincinnati decision last week, Bell stock jumped from 207 to 215 on the Boston Exchange.

Growth in Colorado.—The Colorado Telephone Company are building a line to connect Cañon City with Pueblo and Denver.

The New York and Pennsylvania Company gives notice that it will redeem the dividend scrip issued Oct. 10, 1884, and pay accrued interest upon presentation of the certificates at the treasurer's office. Interest on scrip will cease on Dec. 10.

Obnoxious Poles.—A special dispatch of Nov. 13 from Cleveland says: The Circuit Court at Warren, O., yesterday decided in favor of the plaintiff a suit brought by a farmer to restrain the erection of poles in front of his premises by the Overland Telephone Company. The court held that the erection of the poles was an additional burden to the land not contemplated in the original grant of the highway to the public, and that the line cannot be erected without the consent of adjoining owners. The case will be carried to the Supreme Court.

The Fight at Rochester, N. Y.—Arguments before Mayor Parsons on the question of approving the action of the Common Council in ordering down the wires and poles of the Bell Telephone Company were made on Nov. 12 by M. W. Cooke for the dissatisfied subscribers and the Hon. George H. Raines and George T. Parker for the company. A large number of citizens were present. It was argued, on behalf of the company, that the present tariff was too low, and that it was impossible to make a fair profit at the present rates. It was held that the contract of the company with the city could not be abrogated. Mr. Parker declared that the Common Council had no control over the erection of telegraph or telephone poles, and had no authority to interfere with the business of the company in such an arbitrary way. Senator Raines said the action of the Council was a "boycott by municipal legislation." On the other hand, the Mayor was urged by counsel for the people to protect the rights of the citizens and prevent them from being curtailed by a wealthy corporation which had control of the telephone exchanges throughout the United States.

Trickery by Telephone.—It is alleged that by a skillful use of the telephone in Newark last week, a young man there contrived to obtain $300. A man who said he was John W. Hyatt, the water-filter manufacturer, telephoned to Feary Brothers asking them to send word by wire to the Western Union office in New York to give Alexander Grant a check for $300 for him, and he would pay the money on his way from the Hyatt factory on Commerce street. Ferry Brothers had accommodated Mr. Hyatt and others before, and therefore they told their bookkeeper to wire to New York that it was all right. Soon afterward a young man who said he was Alexander Grant asked at the Western Union office in New York if there a check for him. He was asked if he could find somebody to identify him. He brought in John P. Delaney, jeweler, at No. 2 Astor House, who identified him as Alexander Grant, one of his customers for diamonds. An employé of Delaney's accompanied the young man to the bank to identify him. But the bank officers would not cash the check until Mr. Delaney indorsed it. Mr. Delaney is therefore out $300. The young man is now under arrest.

THE ELECTRIC LIGHT.

Fonda, N. Y.—The new knit goods factory is to be lit by electricity.

Fall River, Mass.—The new Globe yarn mill has a Westinghouse plant.

The Woonsocket, Mass., Rubber Works have put in the electric light.

Le Roy, N. Y., is to have the electric light. Mr. C. W. Keeney has the matter in hand.

Berlin, Germany, has 152 electric light plants, with 736 arc lamps and 12,705 incandescents.

Attica, Ind.—Messrs. Little & Putnam, of this place, intend putting up an incandescent plant.

In the Vatican.—The plant for the Vatican is now in course of preparation, and the Pope is said to take great interest in it.

A French Gas Company Converted.—The gas company at Marseilles is putting up a central station for electric lighting.

Torrington, Conn.—The Torrington Electric Light Company has been organized by Mr. A. F. Migeon and others with a capital stock of $12,000.

Harlem, N. Y.—The Harlem Lighting Company of this city has been incorporated by Clinton H. Leggett and others with a capital stock of $100,000.

In a Boston Brewery.—Sowdon, Elder & Wright have begun the installation of an American electric light plant for Messrs. H. & J. Pfaff, brewers, Boston.

The New Edison Works.—The Jarvis Engineering Co. of Boston have completed setting the second boiler with the Jarvis furnace for the Edison Machine Company, Schenectady, N. Y.

Kansas City.—The Kansas City Electric Light Company have just taken two 60 h. p. engines (being the fourth order) from A. L. Ide & Son, making five Ide engines and two Corliss now in use in the station.

Jacksonville, Fla.—The American Illuminating Company, Jacksonville, Fla., have purchased another dynamo and a 50 horse-power engine for their works, and expect to put in two 70 horse-power boilers soon.

New Haven, Conn.—The New Haven Electric Light Company have recently set their boilers with the Jarvis patent boiler setting, and have ordered another Armington & Sims engine from the Jarvis Engineering Company.

The American Electric Manufacturing Company publishes in this issue a partial list of plants installed by it since last February. It is a remarkably good showing, but is likely, it appears, to be even excelled by the work now in hand and under negotiation.

Gloucester, Mass.—The Jarvis Engineering Co. have recently completed a steam plant for the Le Page Liquid Glue and Cement Co., Gloucester, Mass., consisting of a steel tubular boiler with the Jarvis setting, and an Armington & Sims engine to run their machinery and electric light.

Auburn, N. Y.—News comes from Auburn of the purchase there by the Brush-Swan Company of the Thomson-Houston plant. The consolidation takes effect January 1. The new corporation will probably be called the Auburn Electric Light Company, and its capital, after the change, will be $100,000. This will put an end to cut rate competition and leave a good business at living profits.

Edison Interests.—A special meeting of the stockholders of the Edison Electric Light Company will be held Dec. 8. The transfer books will close Nov. 25, and reopen Dec. 9. The object of the meeting is to submit to the stockholders for their action an agreement providing for the consolidation of the Edison Electric Light Company with the Edison Company for Isolated Lighting into a new company to be known as the Edison Electric Light Company. It is proposed to give the Isolated stockholders one share in the new company for four in the old. The Edison Electric will exchange even.

The Westinghouse Company.—At the late meeting of the stockholders of the Westinghouse Electric Company, of Pittsburgh, it was voted to increase the capital stock of the company to $5,000,000, and to purchase from Mr. George Westinghouse, Jr., the exclusive right to the Gaulard & Gibbs invention, the patent for which was recently issued, and which was announced generally throughout the press, leaving $1,000,000 of stock in the treasury for sale at par. Preparations are being made at the works to manufacture apparatus necessary for 2,000 to 3,000 lights per day. Many letters are being received from gas companies as well as electric-light companies which are desirous of acquiring the right to use this new system of electric lighting.

A Fine United States Plant.—The Cambridge, Mass., Electric Light Company having established a plant at No. 23 Main street, working under the United States or Weston system, issued invitations to the Cambridge city government and a large number of prominent citizens to view its premises, and over two hundred responded, on Nov. 11. The machinery is placed in the

town hall, which is 130 feet long and 50 feet wide. The engine is of the double acting Buckeye pattern, 300 horse-power, and there are two boilers each, of 120 horse-power. There are ten dynamos, running 20 arcs or 240 incandescent, 16 candle-power. Everything pertaining to the plant is of the newest and most approved patterns, and was examined by the numerous guests of the company with the liveliest interest. After the inspection there was a supper served in the upper hall, the room being illuminated by 120 incandescent lights, at which the superintendent, Mr. E. H. Mullaken, presided. Mayor Russell turned on the circuit which illuminated the city at 5 o'clock.

APPLICATIONS OF POWER.

The Enos System.—An exhibit was again made of the Enos system of transportation at the Daft Works, Greenville, N. J. In this system the car is below the rails, and carries a Daft motor. It is not unlikely that the system will be in use next summer at Coney Island.

The Third Avenue Road in this city is about to give up horse traction. At the yearly meeting held last week, the principal topic discussed was a change to either electricity or cables, and it was found that a majority of the directors favored electricity. The road has 3,000 horses.

For the Pennsylvania Road.—Mr. Hiram Rhoades, of Williamsport, Pa., assistant superintendent of the Northern Central Division of the Pennsylvania road, has been in this city examining motors. There is said to be some idea of putting them on branch lines "and finally on the main line."

The New Field of Invention.—Some idea of the energy with which electricians are devoting themselves to the use of electricity for locomotive purposes may be gathered from the statement of one inventor, who informs us that he has nearly 2,000 claims now pending in the Patent Office on electric railways alone.

Proud of His Elevator.—Mr. W. H. Zinn, a leading and enterprising house furnisher in Boston, has lately equipped his large store with an electric passenger elevator, run by a Sprague motor and using current from the Edison Company. He makes a special note of it in his advertisement and asks his patrons to "experience the sensation of being lifted by electricity." It is, he asserts, "absolutely safe" and "the passenger elevator of the future."

PERSONALS.

Mr. E. H. Goff, President of the American Electric Manufacturing Company, made a visit to Washington this week to see the President about lighting the Statue of Liberty.

Mr. W. F. Swift, the secretary of the Brush Company, told a reporter recently that he had traveled over the country a great deal lately, and it was astonishing to note the wonderful growth of the electric light. Every city and town and even villages had adopted it, and it was superseding gas for streets everywhere, just as gas had superseded coal oil.

Mr. F. M. Ricketts sailed from Brooklyn on Nov. 11 in command of the barge "Bella," with 12 nautical miles submarine cable, which the F. M. Ricketts Company is to lay for the United States Signal Service between Block Island and the mainland. The barge was towed by the tug "E. Luchenbach," on which was Mr. M. W. Goodyear. After laying the Block Island cable, Mr. Ricketts proceeds to Cape Charles, where he will put down another cable from that point to Cape Henry for the Signal service. This cable is 15 nautical miles long.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

November 16, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	40
Am. Tel. & Cable	78½	79½
Cen. & So. Am.	75	100
*Com. Tel.	.....	.....
*Gold & Stock	92½	97½
*Inter. Ocean Tel.	90	.....
N. Y. Mutual	.....	.....
Pac. & Atl.	45	55
*Postal T. & C.	15	25
South. & Atl.	65	75
W. U. Tel.	78⅝	78½
W. U. Scrip.	70	.....
W. U. Bonds	.....	123
Mut. U. Bonds	84¼	85¼
TELEPHONE.		
Am. Bell	209	209½
Am Speaking	105	.....
Erie	28½	29
*Hudson River	.....	55

TELEPHONE.	Bid.	Asked.
Mexican	1½	.....
*N. Y. & N. J.	85	.....
N. Y. & Pa.	.....	.....
New England	44¼	44½
*Southern Bell	100	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	90	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	100
*Edison	140	.....
*Edison Ill	85	.....
*Edison Isolated	70	.....
*United States	45	.....
*U. S. Ill	90	100
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

MISCELLANEOUS NOTES.

National Electric Company.—At a meeting of the directors of the National Electric Company, held at Elgin, Ill., Nov. 9, it was resolved that the main offices should thereafter be located at Elgin. The office in the Ogden building, Chicago, will now be used as a branch office.

Secondary Batteries in England.—We hear upon reliable authority that the Edison & Swan Electric Light Company, of London, England, have taken out licenses from the Electrical Power Storage Company for the right to manufacture certain kinds of accumulators to be used with Edison lamps.

An Electrical Entertainment.—"Tony" Pastor will offer a remarkable attraction at his house this week. It will be an electrical exhibit, in which the application is made by the action of a parlor organ, played by a young lady. As she plays, lightning flashes about the house, drums beat, cymbals clash, goblin drums are heard, weird lights appear and disappear, pictures are shown by lightning, displaying mills in motion; birds sing, and there is a storm at sea, with shipwrecked vessels in the whistling wind and all the accompanying effects of rain, hail, storm, etc.; balloons ascend, and there is an electric railway.

BUSINESS NOTICES.

Removal.—Mr. A. F. Fleischmann, manufacturer of electrical apparatus, formerly located at 1226 Chestnut street, Philadelphia, has removed to 1812 Market street.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Anti-Magnetic Shields.—Messrs. Giles Bros. & Co., Chicago, Ill.: Gentlemen: Your Anti-Magnetic Shield for Watches cannot be overestimated. It is now very near eight months that I have worn my watch, and to-day it is, without ever correcting time, about one minute slow. Considering the fact that I am every day near Dynamo-Electric Machines in our regular business, the test could not be harder. I could never have believed that the protection was so complete.

In this age of electricity, not only electricians, but every one who needs correct time, should have the Anti-Magnetic Shield. A good deal of practical utility, as well as pleasure, can be derived from a good time-keeper. At present I look upon a watch without a shield as a thing incomplete; and so it is.

Very respectfully, CHAS. J. VAN DEPOELE,
Electrician V. D. P. E. M. Co.

Address GILES BRO. & CO., for particulars, price, etc.

The Bowsher Speed or Motion Indicator, made solely by N. P. Bowsher, South Bend, Ind., is specially adapted for use with electric light and power machinery, and is strongly approved by hundreds who have used it. It consists of a cylindrical case twelve inches in diameter and twelve inches long, provided with a pointer and suitable dial (the figures on the dial being subject to change, always showing the speed of the shaft to which connected). The pointer is connected with a rack-bar and pinion to a properly constructed ball governor, the governor being located in the centre of the case, having suitable bearings at the top and bottom. This excludes all dust and dirt from the working parts. If the speed of the machinery to which the indicator is connected is uniform, the pointer will remain stationary at a certain point, but if the speed decreases the pointer will move back on the dial, or if the speed increases it will move forward at the same ratio, always indicating the exact speed of the machinery in figures. The alarm is arranged so that when the speed is "too fast" or "too slow," the hammer strikes a gong, and may be adjusted so as to give any amount of variation of the motion desired from a given speed before striking the alarm. It requires no care or attention, as it is always in readiness to alarm when there is a change in the motion, although the hammer may be "hooked back" so as not to alarm at any speed.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED NOV. 2, 1886.

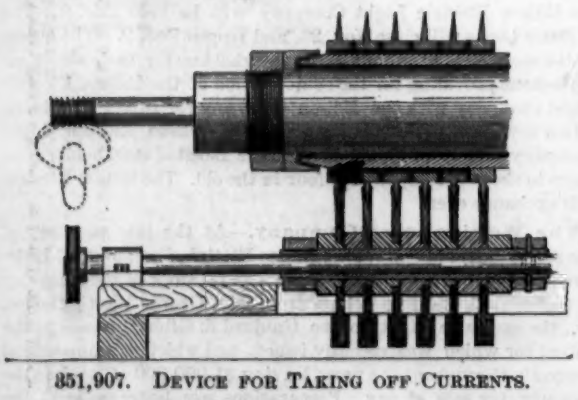
351,772. Burglar Alarm; John W. Hoffman, Pullman, Ill. The object is to provide means whereby an alarm will be sounded whenever the partitions between the berths of a sleeping-car are removed, as by a person designing to abstract valuables from under the pillows of the passengers.

351,834. Telegraph Key; Marion R. Jenkins, Browning, Mo. The objects are to prevent "sticking" to relieve the operator's hand of jarring, and to facilitate the opening and closing of the circuit preparatory to the use and disuse of the key.

351,855. Electric Lamp; Thomas A. Edison, Menlo Park, N. J., Assignor to the Edison Electric Light Company, New York, N. Y. The first claim describes the invention. The combination of an exhausted glass inclosing globe and a carbon filament within the same secured to metallic wires, said globe being sealed directly upon said wires.

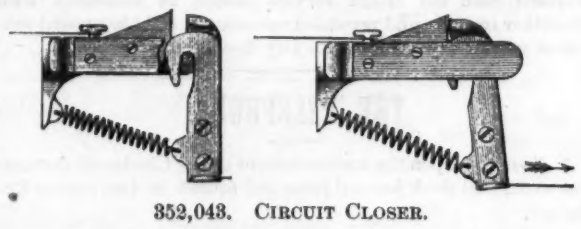
351,856. Incandescent Electric Lamp; Thomas A. Edison, Llewellyn Park, N. J. This lamp is in the form of a globe, having a glass disc sealed into it and the leading-in wires are sealed into the disc. The object is to provide a cheap lamp.

351,869. Incandescent Lamp; William P. Kookogey, Brooklyn, N. Y. The invention relates to a lamp filament. The filament has its middle portion made broader than its ends, and its ends made thicker than the middle portion. The design is to afford a large radiating surface.



351,907. DEVICE FOR TAKING OFF CURRENTS.

(1) 351,902. Magneto-Electric and Electro-Magnetic Machine; (2) 351,903. Magneto-Electric and Electro-Magnetic Machine. (3) 351,904. Magneto-Electric and Electro-Magnetic Machine; (4) 351,905. Telephone; (5) 351,906. Dynamo-Electric Machine or Electric Motor; (6) 351,907. Device for taking Electric Currents from or to Moving surfaces; Rudolf Eickemeyer, Yonkers, N. Y. (1) A series of bars or conductors is caused to rotate across radial lines of force in a magnetic field between concentric magnetic poles. (2) The armature is a compound magnet embodying a series of bar magnets, each of which serves also as an electrical conductor. Both the armature and the outer magnet are double. (3) The armature carries a series of independent electric conductors and an electric circuit repeatedly traverses the armature from end to end in one direction and alternately includes one and more than one of the said conductors. The three patents cover inventions having as a common feature an armature located within an annular field of magnetic force and carrying two or more electrical conductors. (4) The diaphragm is so connected with a bar under torsion and within a helix that when the helix is traversed by and relieved from electric currents the bar, by alternately untwisting and twisting, will cause the diaphragm to vibrate. (5) The armature carries a zig-zag conductor, and its magnetic shell or casing has an annular series of pole-faces. An exciting helix polarizes all the pole-faces. An improvement in multipolar machines. (6) The device consists of a brush in the form of a disc which is rotated positively by suitable mechanism instead of being rotated by reason of frictional contact with another revolving surface. The disc engages with surfaces extending at right angles to its own axis. (See illustration.)



352,043. CIRCUIT CLOSER.

351,913. Protecting Underground Wires and Pipes; Worcester Haddock, Cincinnati, O., Assignor of one-half to Jacob Frank, same place. The object is to render underground electric wires and gas and water pipes easily accessible, and to provide means for retaining them in position.

351,933. Quadruplex Telegraphy; John M. Moffatt, New York, and Edward Blakeney, Brooklyn, N. Y. (For description see page 244 of this issue.)

351,961. Automatic Electric Current Regulator; Charles F. Brush, Cleveland, O. (For description see page 247 of this issue.)

351,973. Electric Lamp; Alenza T. Gifford, Hopedale, Mass. Relates to a focusing lamp. The feeding device of one of the carbons is combined with a switch, which is operated indirectly by the heat radiated from the arc. The feeding device is thrown out of operation when the end of the carbon reaches a certain point, thus determining the position of the arc. The arc is maintained at the proper length by the feed of the other carbon, which is controlled by variations in current strength, dependent on the variations in the length of the arc.

(1) 352,006. Incandescent Electric Lamp; (2) 352,007. Incandescent Electric Lamp; Frederick Schaefer, Boston, Mass. (1) Improvement on an invention shown and described in an application filed October 12th, 1885. (2) The object is to provide a shade which shall be supported on a lamp without the need of employing additional attachments to keep it in place.

352,035. Arc and Incandescent Electric Lighting; Harold P. Brown, Chicago, Ill. (For description see page 244 of this issue.)

(1) 352,043. Circuit-Closer; (2) 352,044. Electro-Mechanical Whistle; Harry B. Cox, Cincinnati, Ohio. (1) The circuit-closer is designed for use in a railway car telegraph, and is operated by a double wire bell cord in the usual manner. (See illustrations.) (2) The whistle is put into operative condition by the action of an electro-magnet.

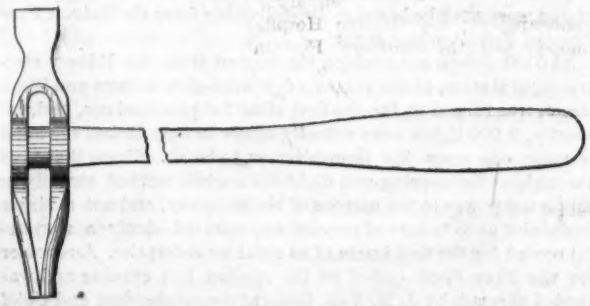
352,059. Steno-Telegraph Instrument; William A. Kaler, Larwill, Ind. An improvement in the key of a printing telegraph apparatus. The key-board has one central key and a number of keys arranged at both sides, all the posts of the keys at one side being electrically connected to the posts of the corresponding keys on the other side.

352,070. Magnetic Tackhammer; Arthur R. Robertson, Somerville, Mass. The body of the hammer-head is divided or bifurcated so as to give it the shape of a horseshoe magnet.

352,074. Commutator Brush; Charles J. Van Depoele, Chicago, Ill. The brush consists of alternate layers of copper and a non-metallic substance, the layers being all arranged transversely to the axis of the commutator cylinder, and thereby interposing their minimum resistance to the passage of the current.

352,084. Medical Induction Coil; Louis Drescher, New York, N. Y. For description, see THE ELECTRICAL WORLD for Oct. 9, 1886.

352,105. Induction Coil; Karl Zipernowsky, Buda-Pesth; Maximilian Déri, Vienna, and Otto Titus Bláthy, Buda-Pesth, Austria-Hungary. For description see THE ELECTRICAL WORLD for Nov. 13 and previous dates.



352,070. MAGNETIC TACK HAMMER.

351,759. Train Signal System; Erwin S. Graver, Philadelphia, Pa. See THE ELECTRICAL WORLD for Nov. 13, 1886, page 237.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.